How I Engineered the Famous Freight Train Dragster in Scale

Steve Perry
GSL XXIII
April 28, 2011

Overview

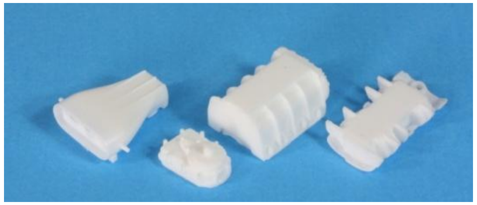
- Intro
- Research and Choice of Subject
- Construction
  - Scaling
  - Reverse Engineering from Known Constraints
  - Powertrain unit
  - Chassis
  - Axle and Steering
  - Bodywork
  - Mock up
  - Finishes
  - Engine Detail
  - Interior Detail
  - Final Detailing
- Results
  - The Freight Train Model as a Replica
  - Measures of Success
  - Conclusion

Builder's Background

- Hometown-La Canada, CA now resides in metro Detroit area
- Model car builder for 4 decades
  - 1st contest trophy, 1978 Los Angeles Custom Car Show-2nd Place Senior Division
  - 2nd contest trophy 2000 Detroit Autorama, 1st Place Street Machine
  - Attended GSL XXI for the first time in 2007

- Features and articles in Scale Auto and Model Cars
- Owner, Calnaga Castings, www.calnaga.com

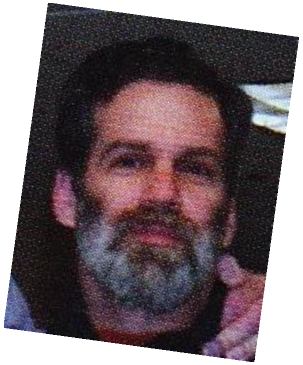
  "High quality custom 1:25 scale model car parts"



- Automotive engineer for one of the Big Three in Detroit
- Married with kids, has a life.

Introduction

- The people


Andy Martin

Ramon Garcia

Mark Gustavson

Tim Boyd

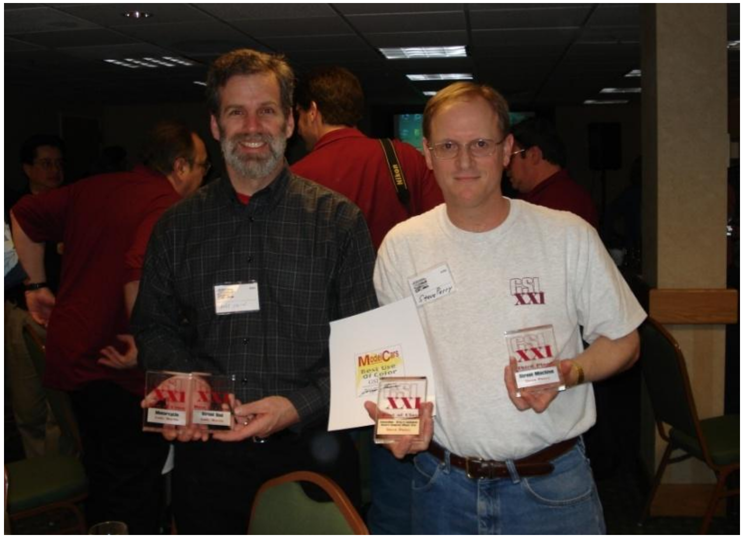
Dave Perry

Gregg Hutchings

Models don't just happen, people make them happen

Introduction

❑ Special Mention



GSL XXI Competitors and Friends

Andy's periodical collection, the "wall o' mags" contains over 3,000 issues of car enthusiast magazines. The Freight Train model would not have been so successful without this invaluable resource.

A regular guy and a role model

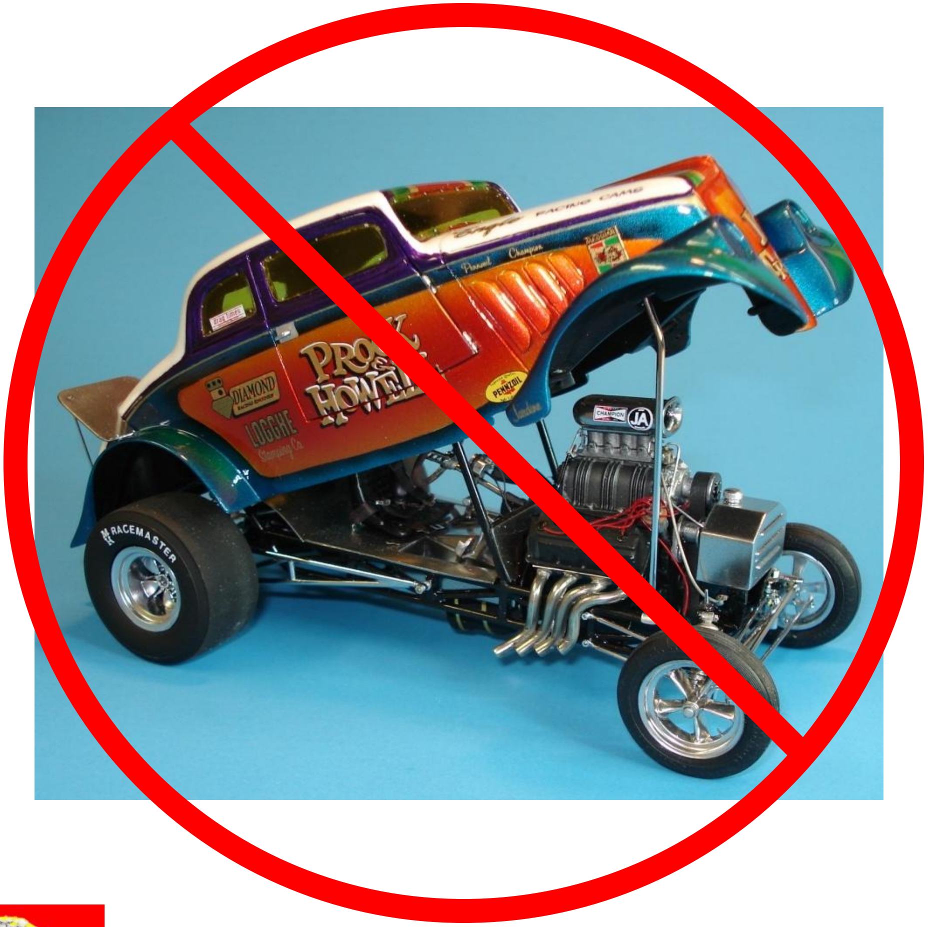
Tim continuously provides encouragement to push the limits, document, and share with others.

Big projects need special support

Choice of Subject

☐ Desired Project Scope

- ✓ Scratch-built frame and suspension
- ✓ Emphasis on engine detail and technical realism.
- ✓ Plentiful research material
- X Simple paint job
- ? Lots of aftermarket parts



The '33 Willys Outlaw Gasser was successful at GSL XXI, but I didn't want a duplicate of the intense body work and painting aspect of the project.

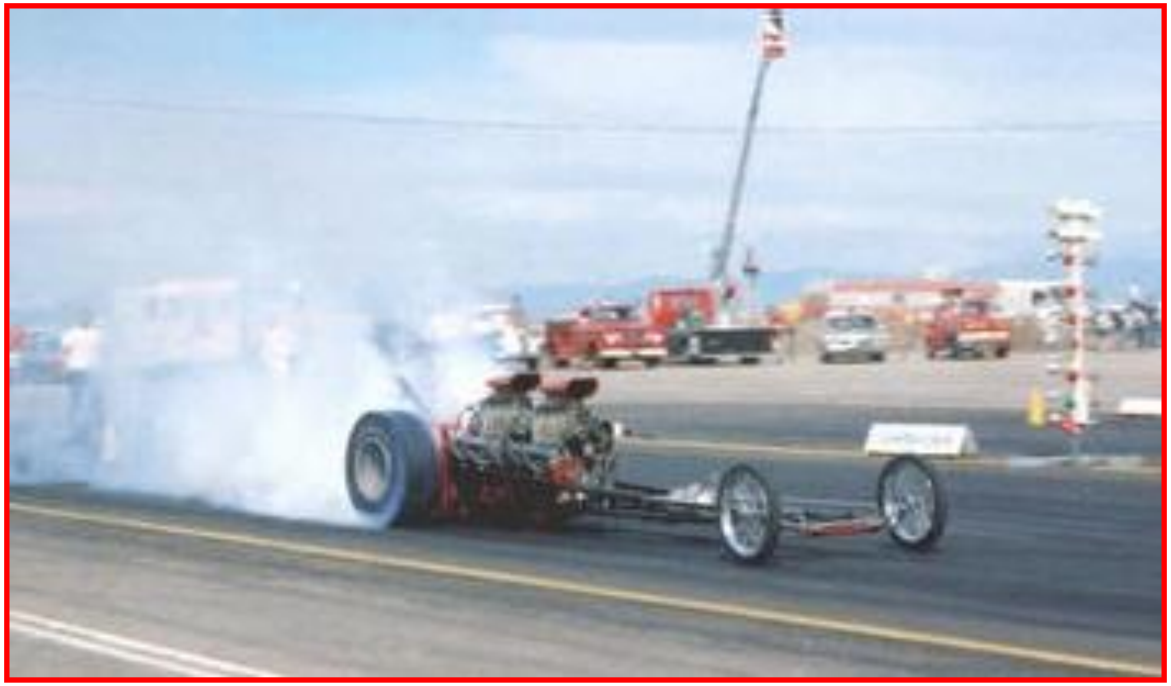
Choice of Subject

- ❑ Intended Outcomes
  - ✓ The fun and satisfaction of building
  - ✓ Accurate, unique replica
  - ✓ Contest success-GSL XXII, Detroit Autorama, etc.
  - ✓ Potential for magazine publication-features and how-to's
  - ✓ Idealistically, have it be a contribution to the hobby

  X GSL XXII Best of Show-not enough content
  X Not another twin engine rail kitbash

Choice of Subject-The Freight Train

- Subject-The Famous Freight Train Gasser
  - Representative of the Gasser Era-Iconic
  - Most Successful Twin
  - Just plain old cool



Bakersfield, '66.

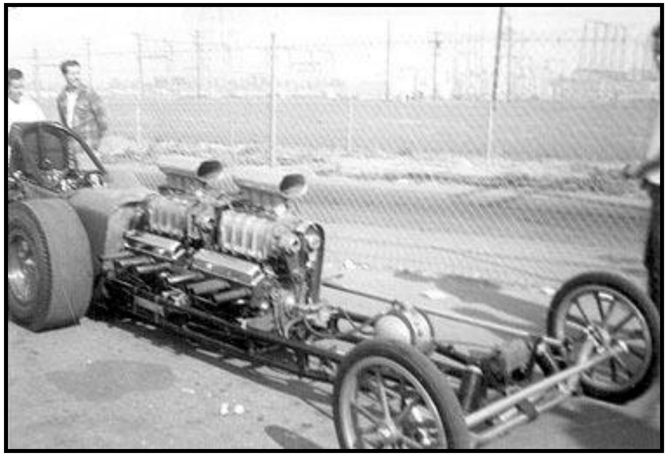
Why Was the 'Train Competitive?

- ☐ The Combination*
  - Power to Weight 1300 HP, 1575 lb
  - High Revving' Chevy's allowed low gearing
  - Chevy's more durable than Hemi at these power levels
  - New Goodyear Slicks

- ☐ Grass Roots Effort
  - Owner John Peters
    - Machinist for Engle Cams
  - Drivers
    - Roy "Goob" Tuller
    - Billy "The Kid" Scott
    - Bob Muravez AKA Floyd Lippencotte Jr.

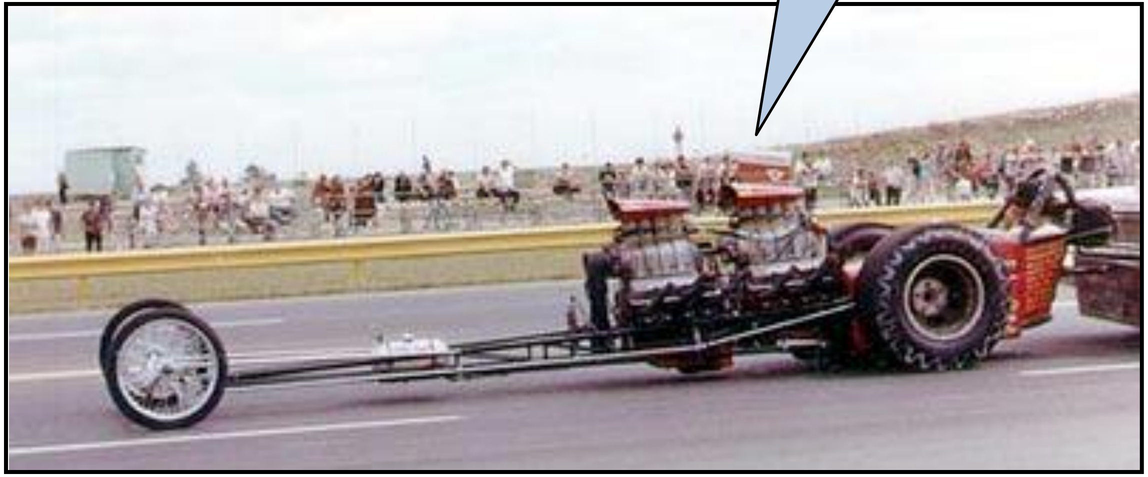
*Reference: **Scott, Dave**; "The Freight Train", *Popular Hot Rodding*, July, 1966

Which Train are We On?



Freight Train 1
1961-1964

Freight Train 2
1966-1967

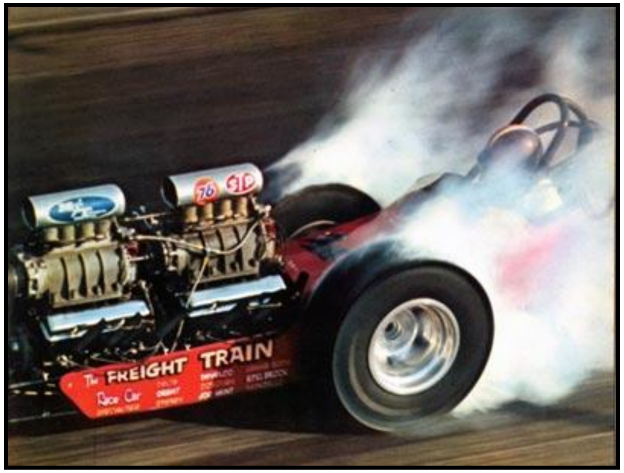


The model is this one

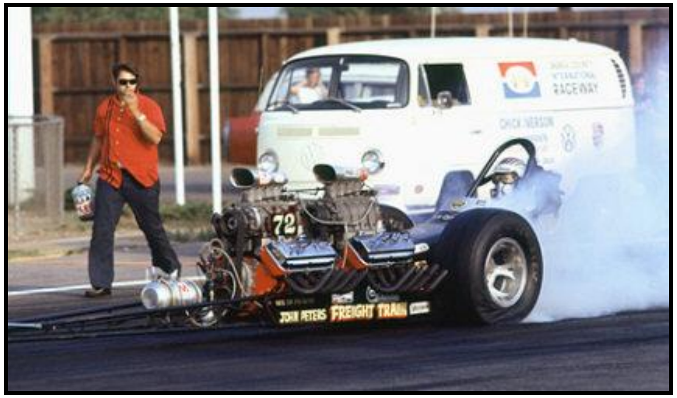
There are actually five different Freight Trains

Which Train are We On?

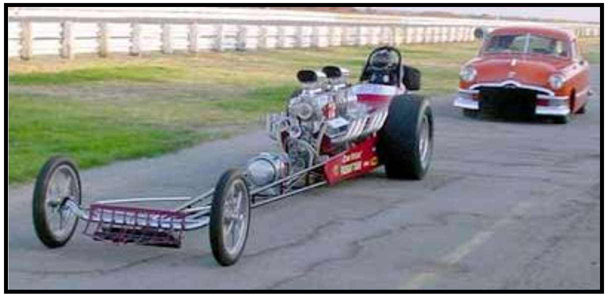
Freight Train 3 (AKA Freight Train B)
1968 to 1970



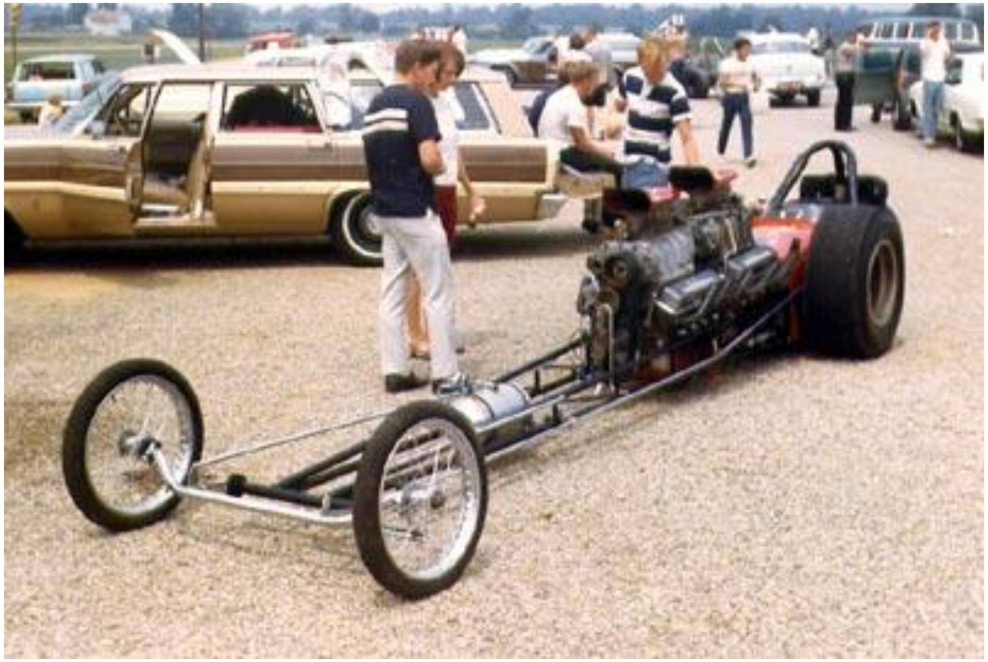
Freight Train 4
1970-1971



Freight Train 5
Present Day Nostalgia dragster



Changes from Race to Race

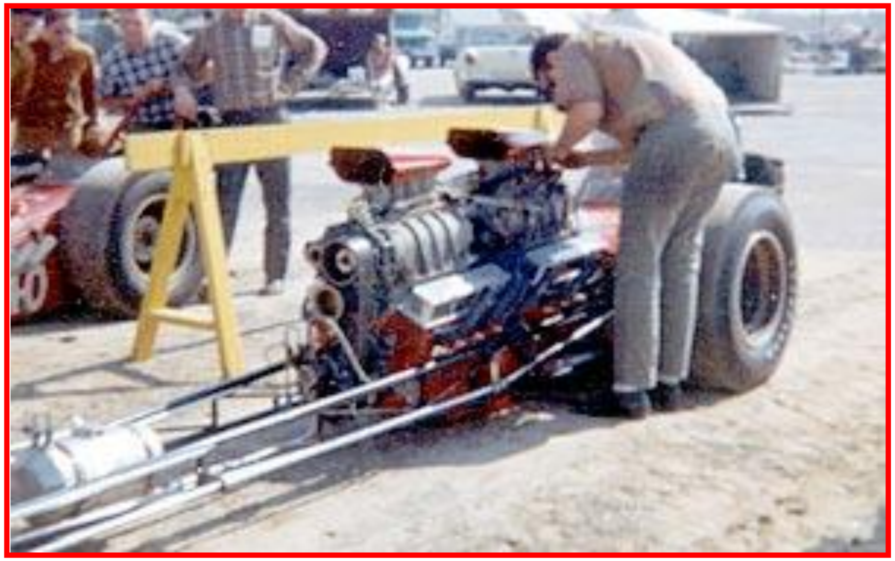


Indy, '66

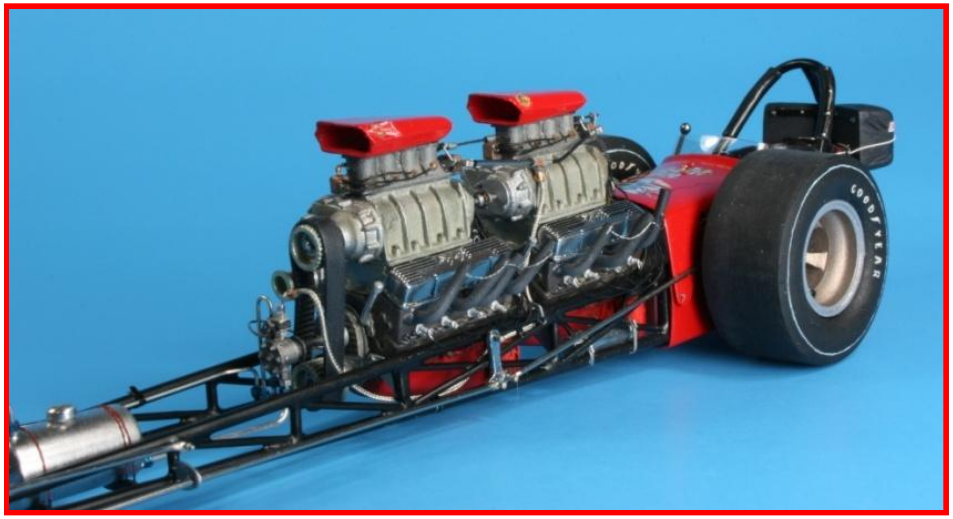
Event/Date	As Built	Winternats Pomona	Fuel and Gas Championships Bakersfield	Lions Shootout Long Beach CA	U. S. Nats Indy	Winternats Pomona	U.S. Nats Indy
Detail	November, 1965	January 1966	March 1966	Summer 1966	September, 1966	January, 1967	September, 1967
Scoops	cast alum	red fiberglass	red fiberglass	red fiberglass	red fiberglass	red fiberglass	alum sheetmetal
Frame diagonals	none	none	none	2 diagonals	2 diagonals	2 diagonals	2 diagonals
Rear Magneto	Schiefer	Schiefer	Schiefer	Vertex	Vertex	Vertex	Vertex
Overflow tanks	none	Left side only	none	firewall tank	left & right side	left & right side	left & right side
Block filler pipes	none	none	none	none	pipes on block	pipes on block	pipes on block
Header pipe retention	flange	flange	flange	chains	chains	chains	chains
Engine Block Finish	front red, rear red	front red, rear red	front red, rear red	front red, rear red	front&rear cast iron	front cast, rear red	front red, rear red

Choice of desired details and features narrowed down the event to the 1966 U.S. Nationals

Let's Get Started!



How do we get from this-

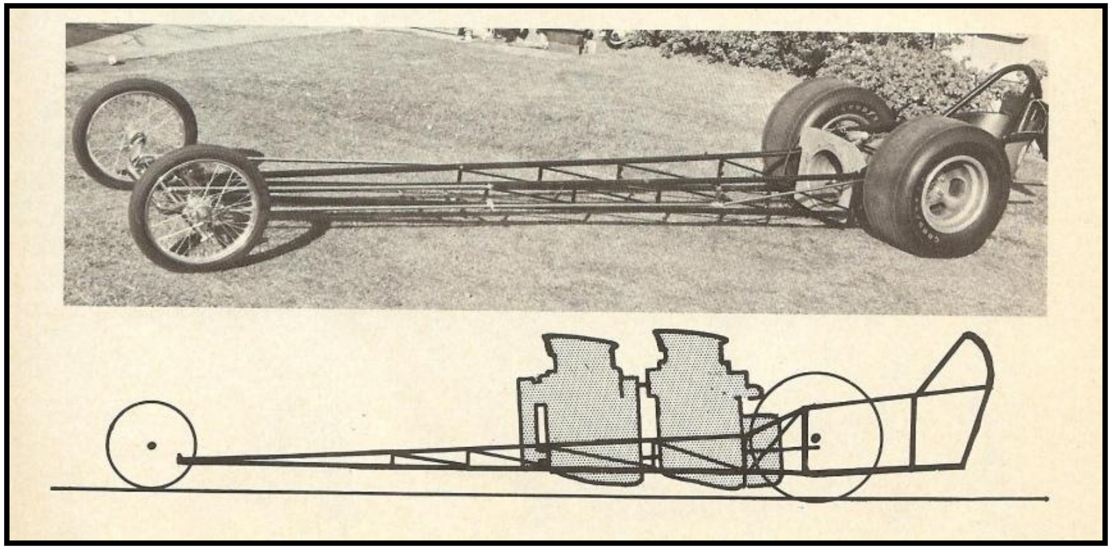


to this?

Scaling Parts

- ☐ Scaling from Known Dimensions

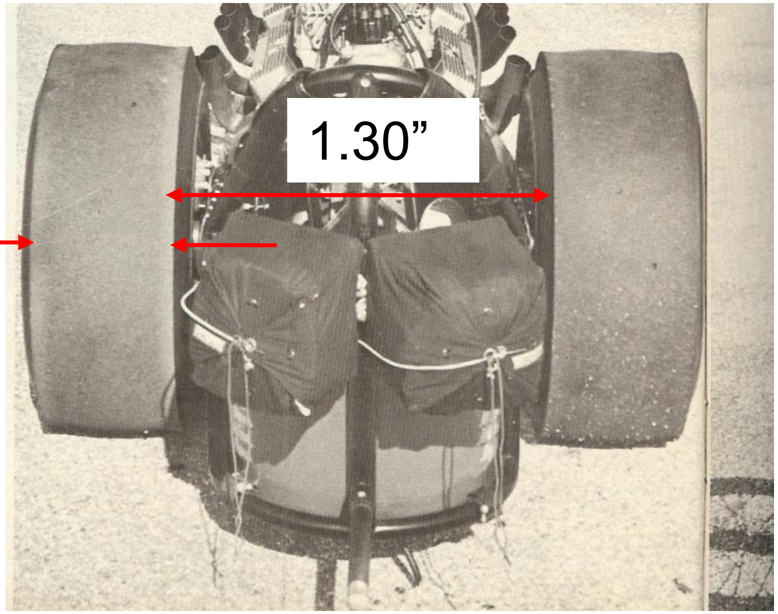
Simple division by the scale
Example: 161” wheelbase
161”/25=6.44”



This is the most fundamental method of scaling and is used extensively if the builder has actual plans or photos including a scale.

Scaling Parts

- ☐ Scaling by proportion of references and known dimensions



Example: Track Width

Track Width full scale

Tire Width full scale

Track Width in picture

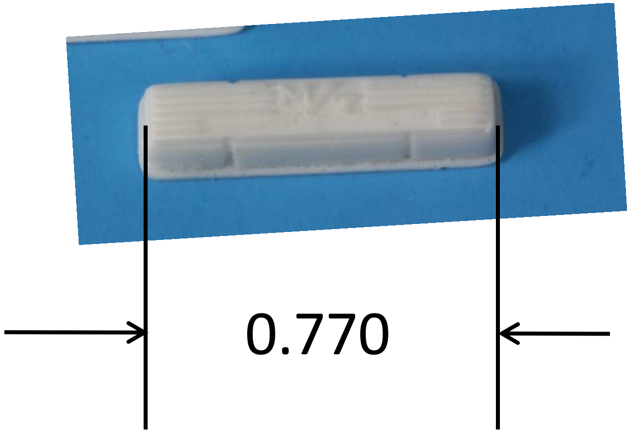
Tire Width in picture

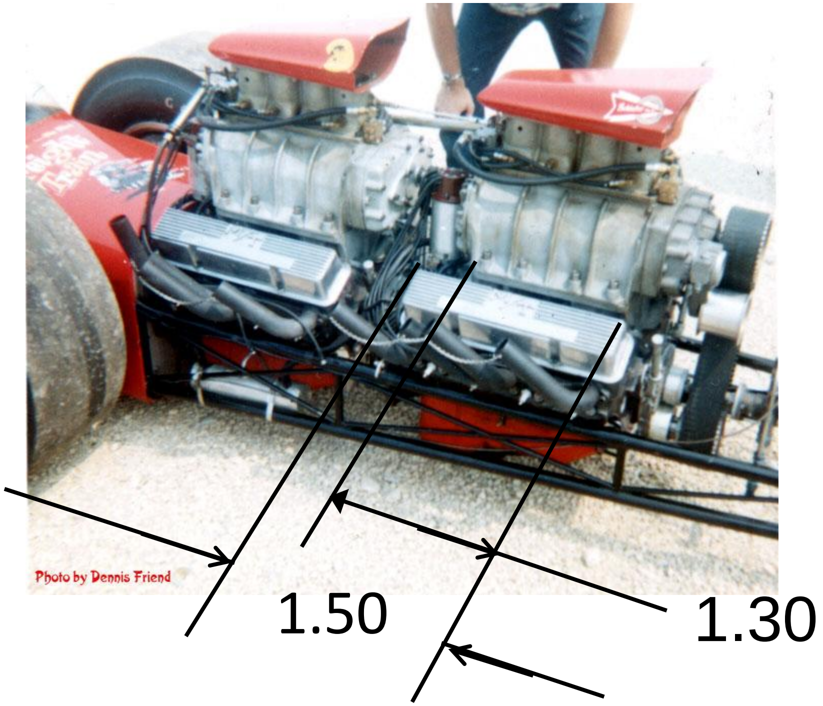
$$\frac{X}{11.0''} = \frac{1.30''}{0.50''} \Rightarrow X = 11.0''\,\frac{1.30''}{0.50''} = 28.6''$$ in full scale

28.6÷25=1.14” in 1:25th scale

Scaling Parts (cont.)

- Scaling by proportion between existing parts





Example: Blower Case Length

Blower case in picture

Model blower case length

$$\frac{X}{0.770} = \frac{1.30}{1.50} \Rightarrow X = 0.770 \frac{1.30}{1.50} = 0.667 \text{ in 1:25th scale}$$

Model valve cover length

Valve cover length in picture

Scaling Parts (cont.)

- ☐ Words about scaling by proportion between existing parts

Scaling one model part from a reference model part is only as good as the scale of the reference part.

However, the proportional sizes of parts relative to each other can have the same impact on realism as actual scale.

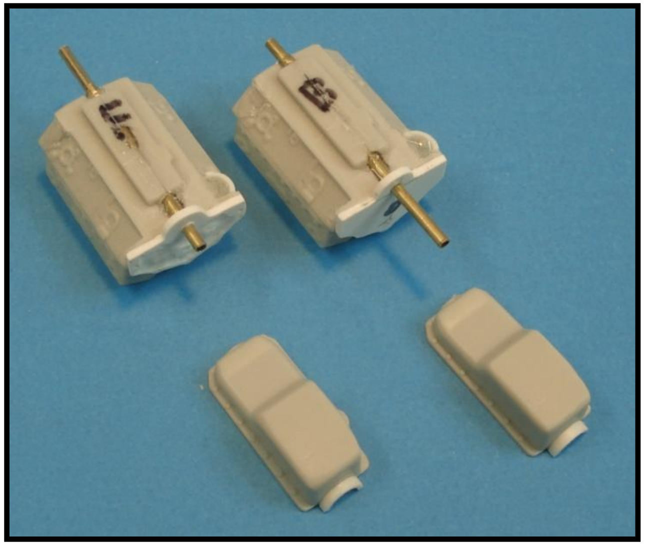
It has been suggested that smaller parts look more realistic if they are slightly larger than scale.

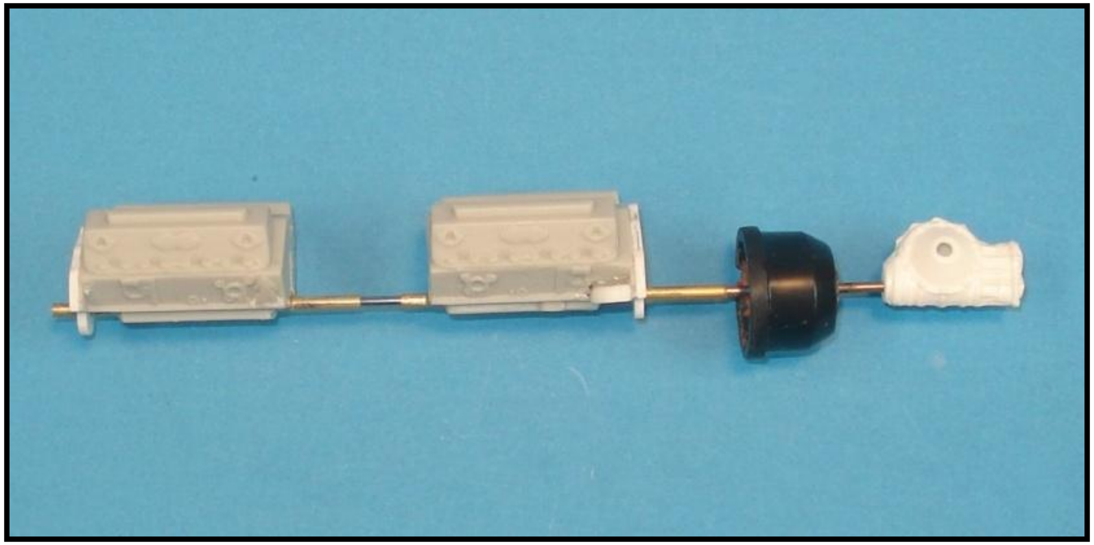
"If it looks right, it is right."-renowned race car modeler

"Scale is your friend." –Steve Perry

Reverse Engineering from Known Constraints

- ☐ The powertrain unit defines chassis dimensions
  - ➢ Crankshafts of engines, clutch, rear end must be on the same axis
  - ➢ Separation of engines was determined by reference photos

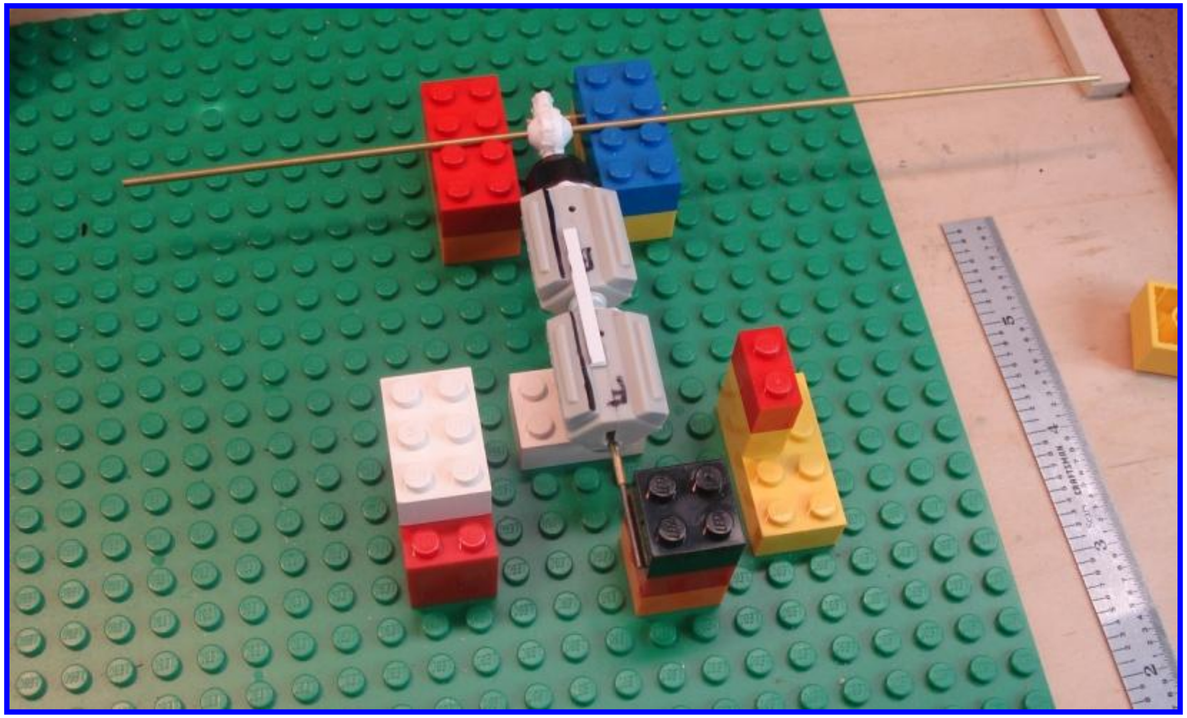




Powertrain unit was the first sub-assembly of the build.
It is foundational to other parts.

Powertrain Unit Assembly

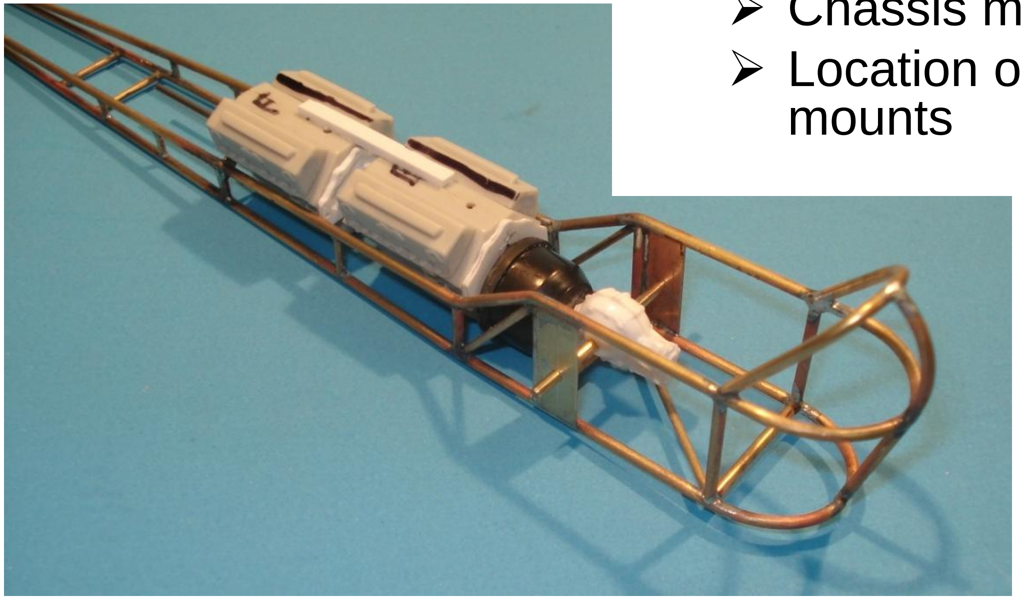
- ❑ The Lego block jig was used to align and pin the engine blocks with the differential



Lego blocks are modular, square, and precise: Excellent for temporary fixtures.

Reverse Engineering from Known Constraints

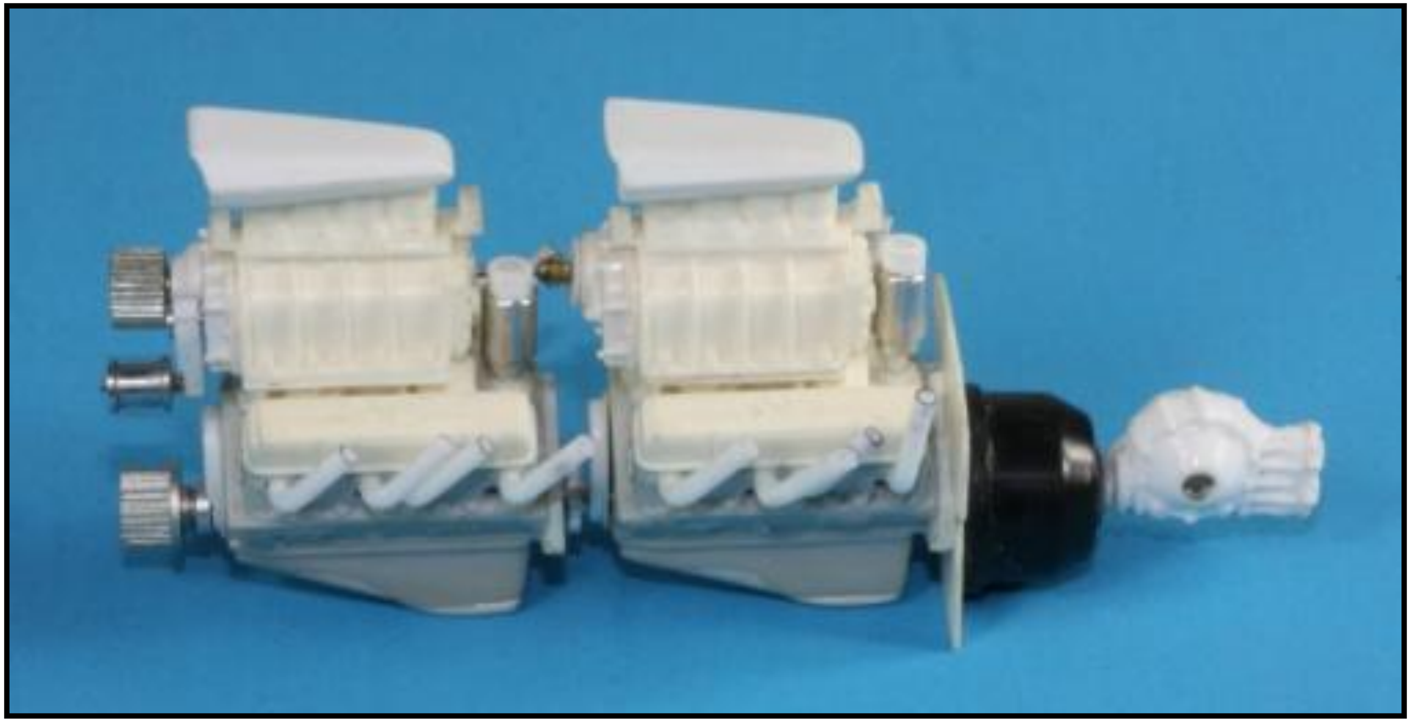
- The powertrain unit defines chassis dimensions
    - Rear axle to engine mount dimensions
    - Chassis width
    - Chassis main tube separation
    - Location of chassis uprights for motor mounts



Reverse engineering combined with scaling techniques enabled design of a very accurately dimensioned chassis plan.

Powertrain Unit Details

Firewall-.020 sheet styrene



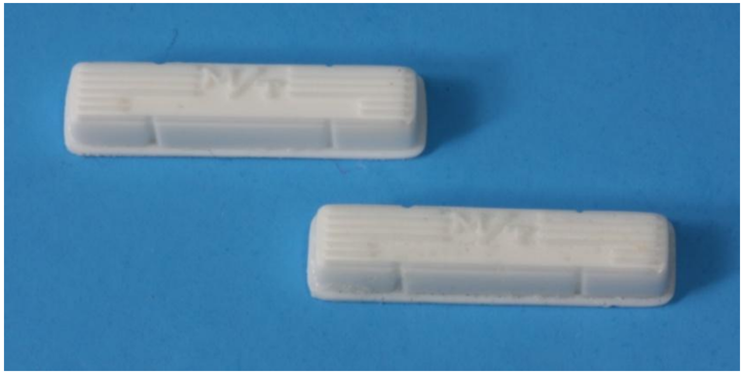
Engine Blocks, heads, pans from AMT 1971 ZR1 Corvette

Clutch Can-parts box, unknown origin

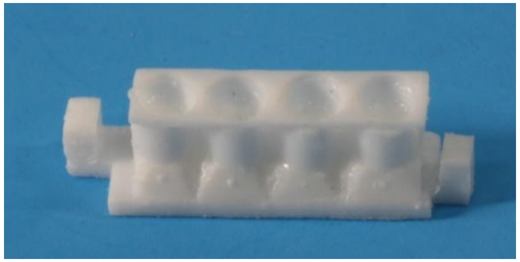
Quick change rear end from Revell Orange Crate

Why Resin Cast?

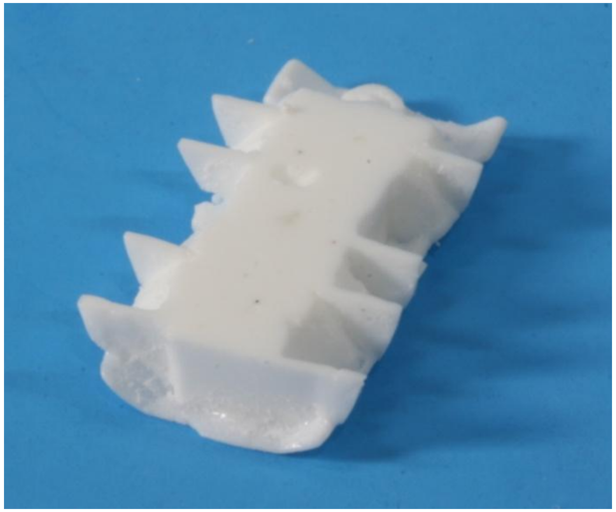
- ☐ Valve Covers



- ☐ Injectors



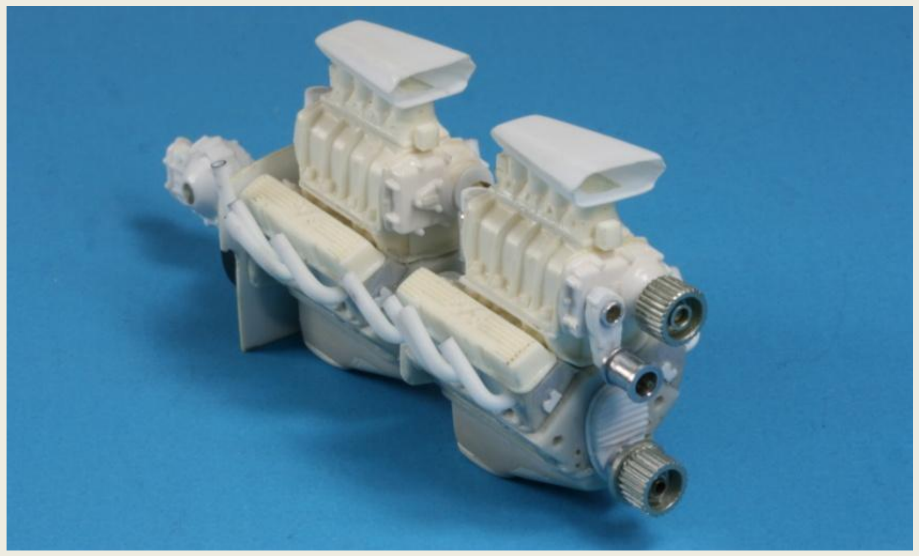
- ☐ Blower Manifold



Duplicate parts were needed for the twin engine rail and it was an opportunity to improve upon available part fidelity.

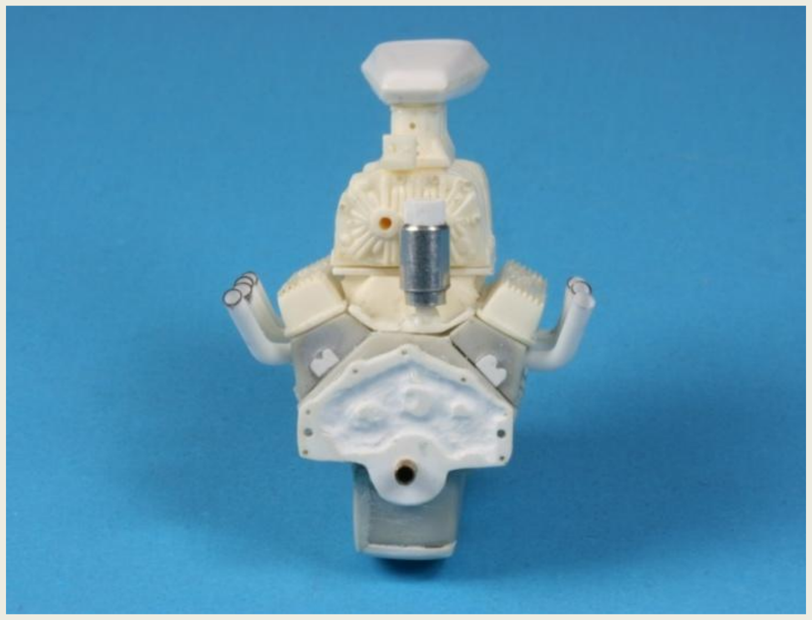
Powertrain Unit Details

Blower Scoops: Vaccum-formed in-house



Valve Covers, intake manifolds, blowers, injectors, timing chain covers: Resin-cast in-house

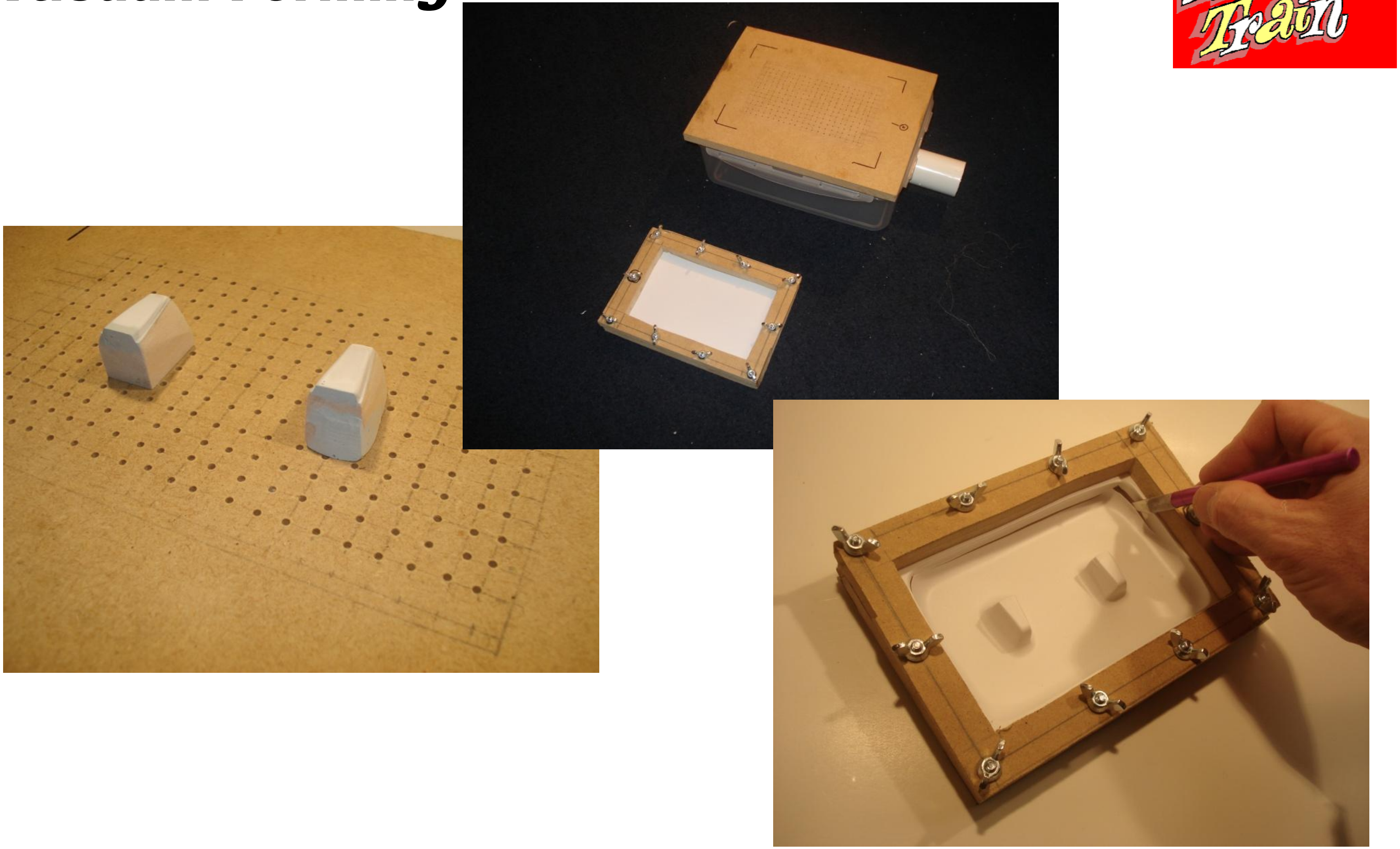
Magnetos: Scratch-built from aluminum tube and styrene rod.



Back of block detail and cylinder head casting marks

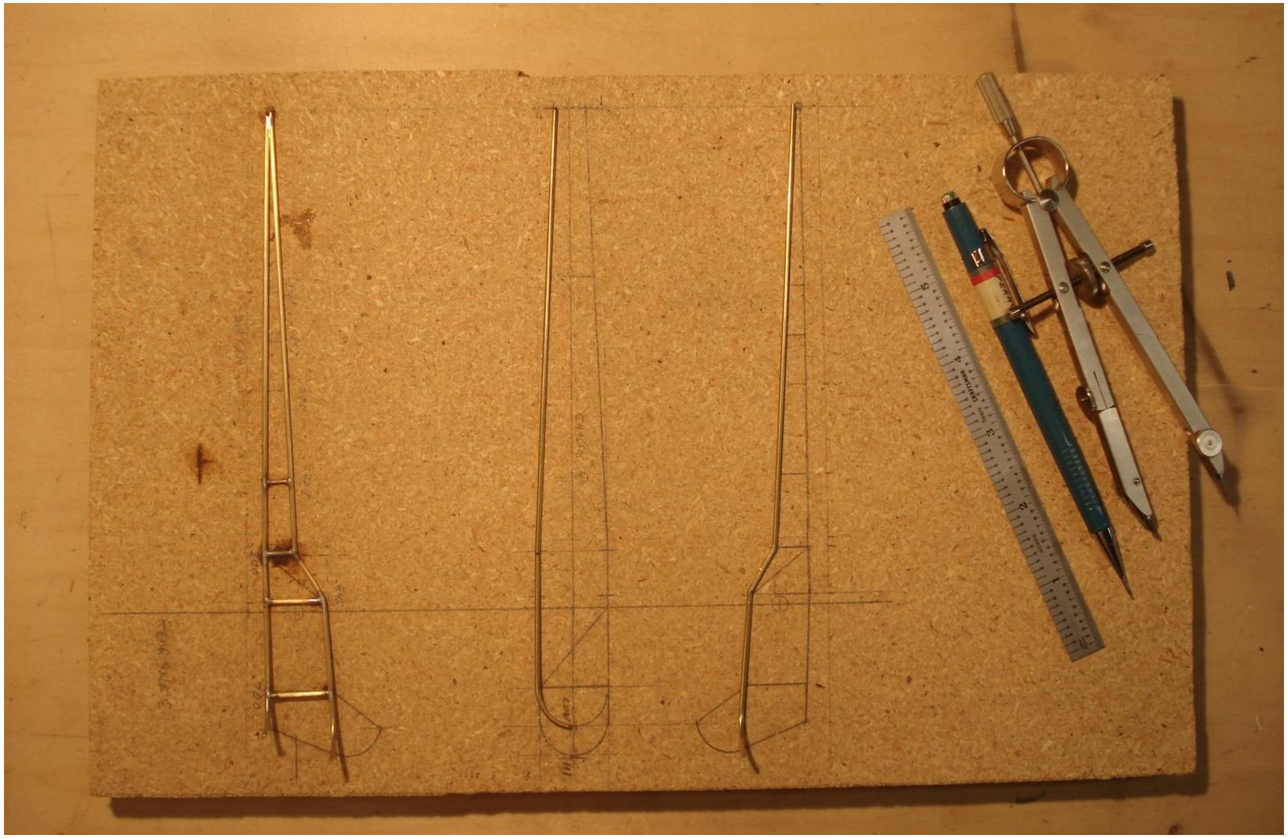
Headers: 0.080” styrene rod, formed and drilled.

Vacuum Forming



Chassis Soldering Jig

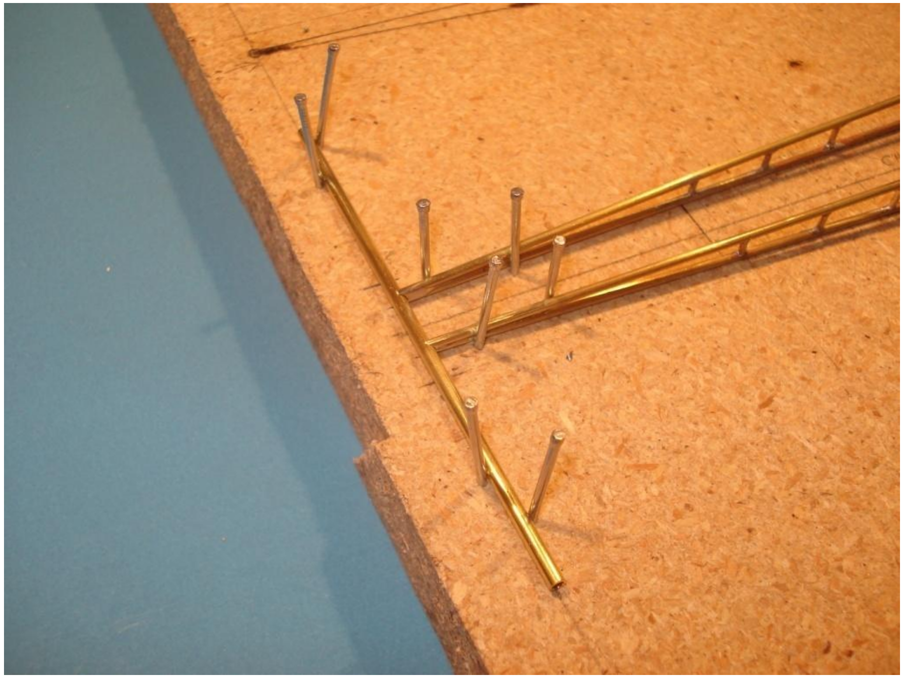
- ☐ The chassis plans were drawn directly on the particle board soldering jig. Finish nails were used to locate the main chassis tubes.
- ☐ Chassis is 0.063” brass rod.



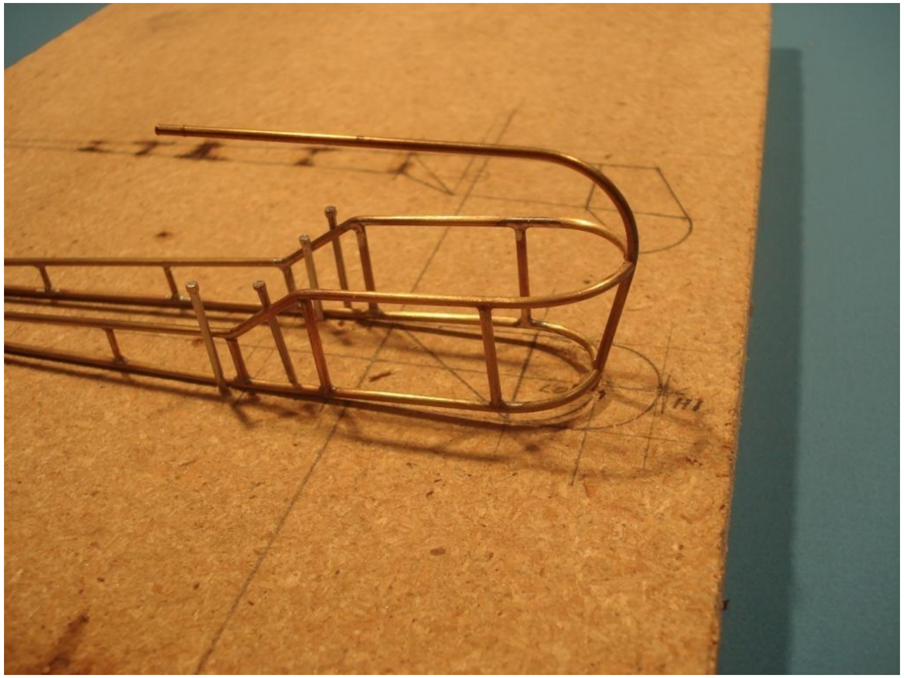
The particle board fixture is low-tech, but effective!

Chassis Soldering Jig

- Angles are easy to control over long distances. The critical front torque tube was accurately fixtured for soldering and cut to size after.

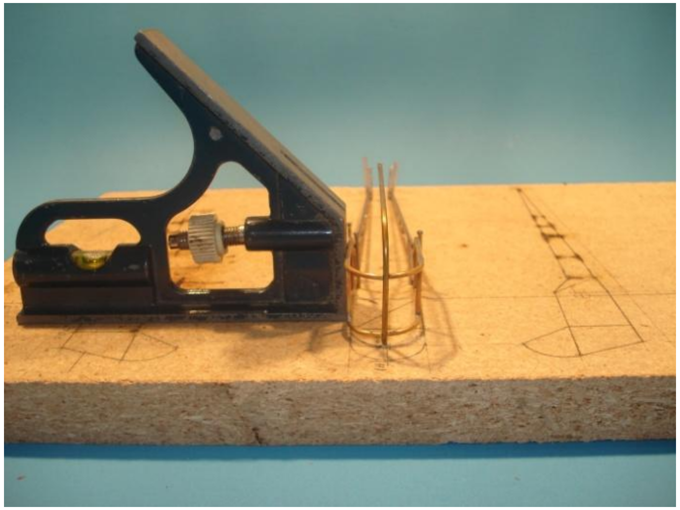


Front torque tube was held square by fixturing a long length.

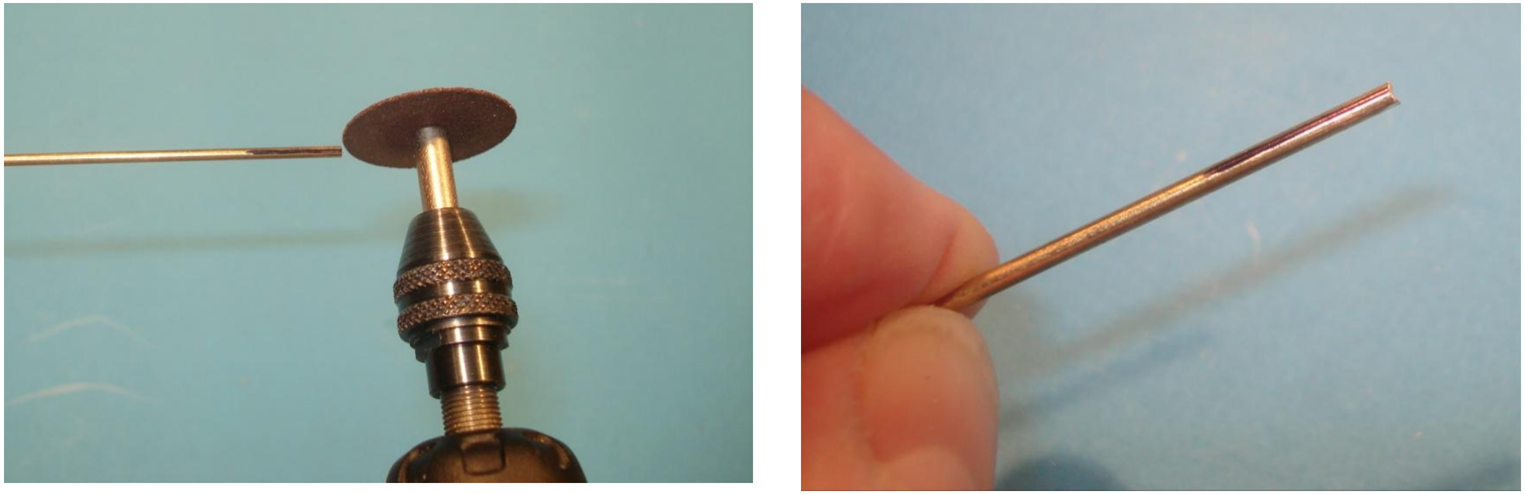


The chassis backbone is curved, but held in a proper plane using the long length method

Chassis Construction

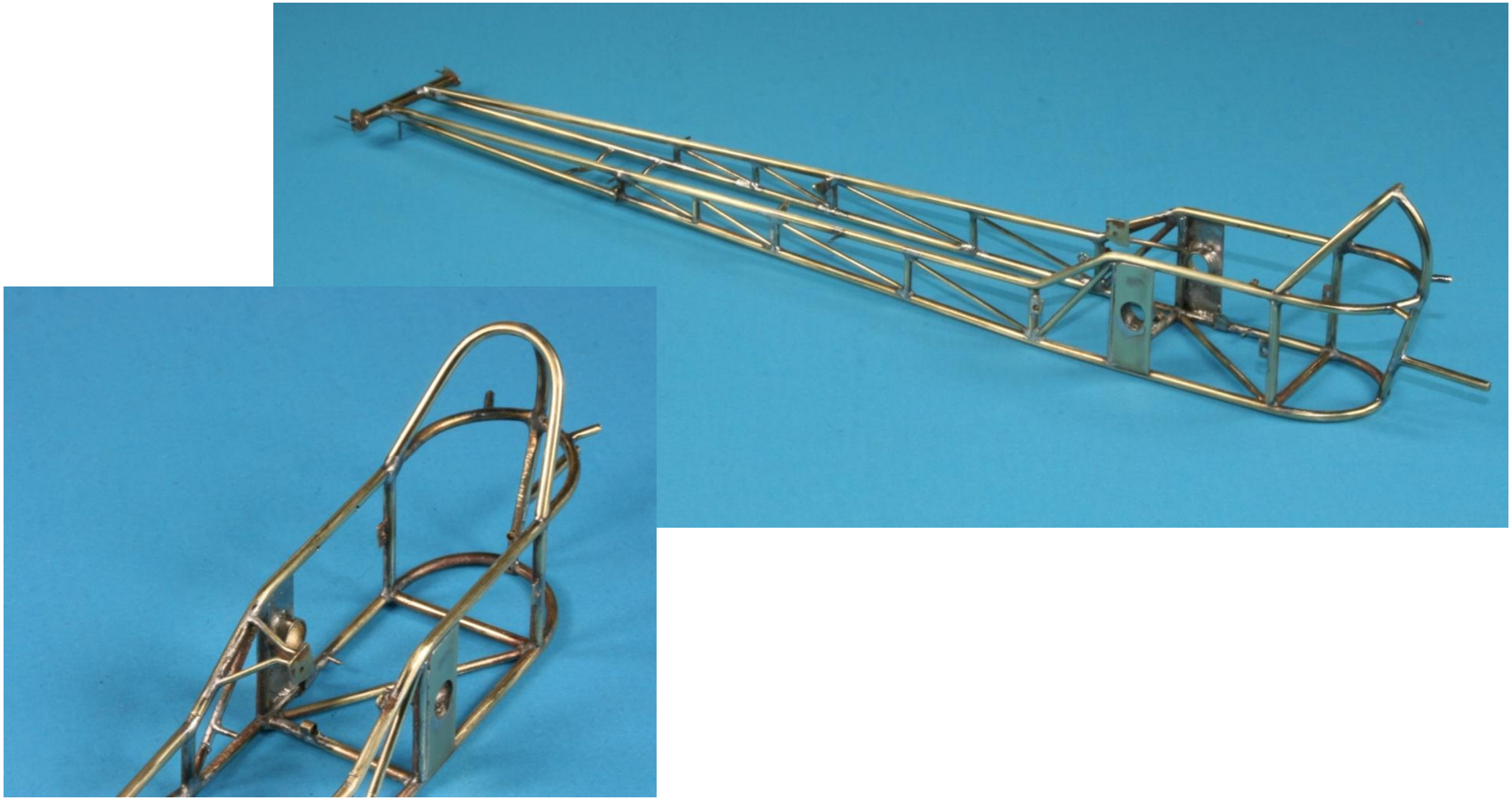


Each chassis side is squared up and fixtured for assembly soldering.



Chassis tubes can be “fish-mouthed” for close fit with a cut off wheel.

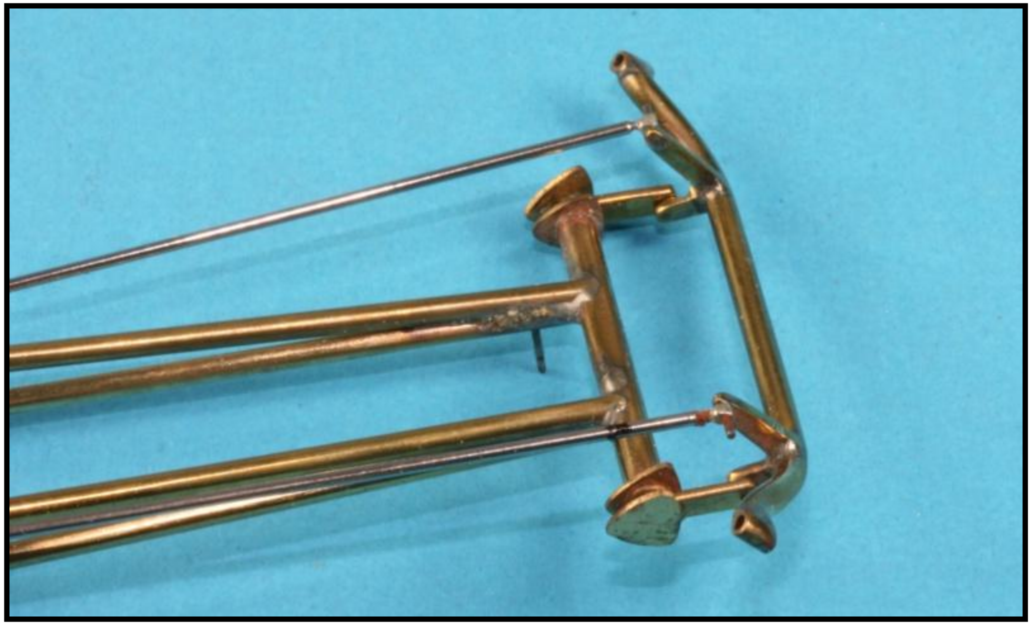
Chassis Construction



Simple methods applied carefully produced a rugged and accurate scale chassis.

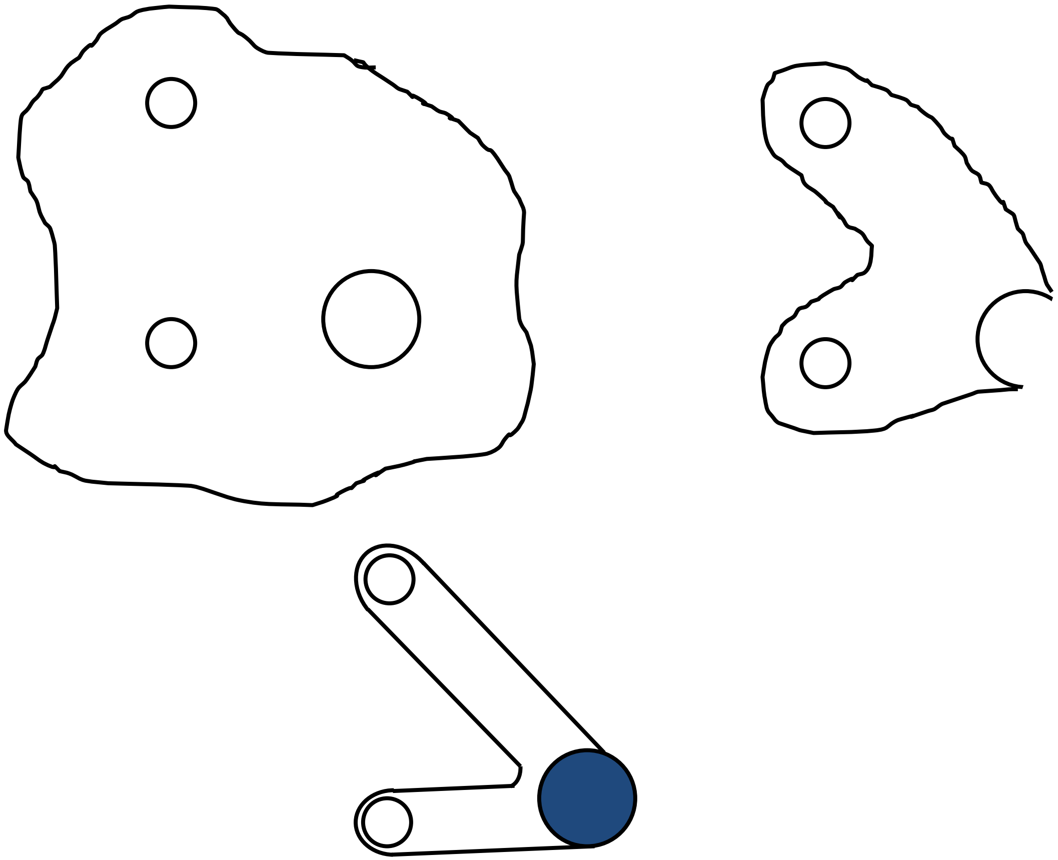
Axle

- The axle is made up of five pieces of brass. The torsion arm and radius rod mounts are a a single piece shaped after soldering
- Steering and suspension links are 0.031” stainless steel tubing.



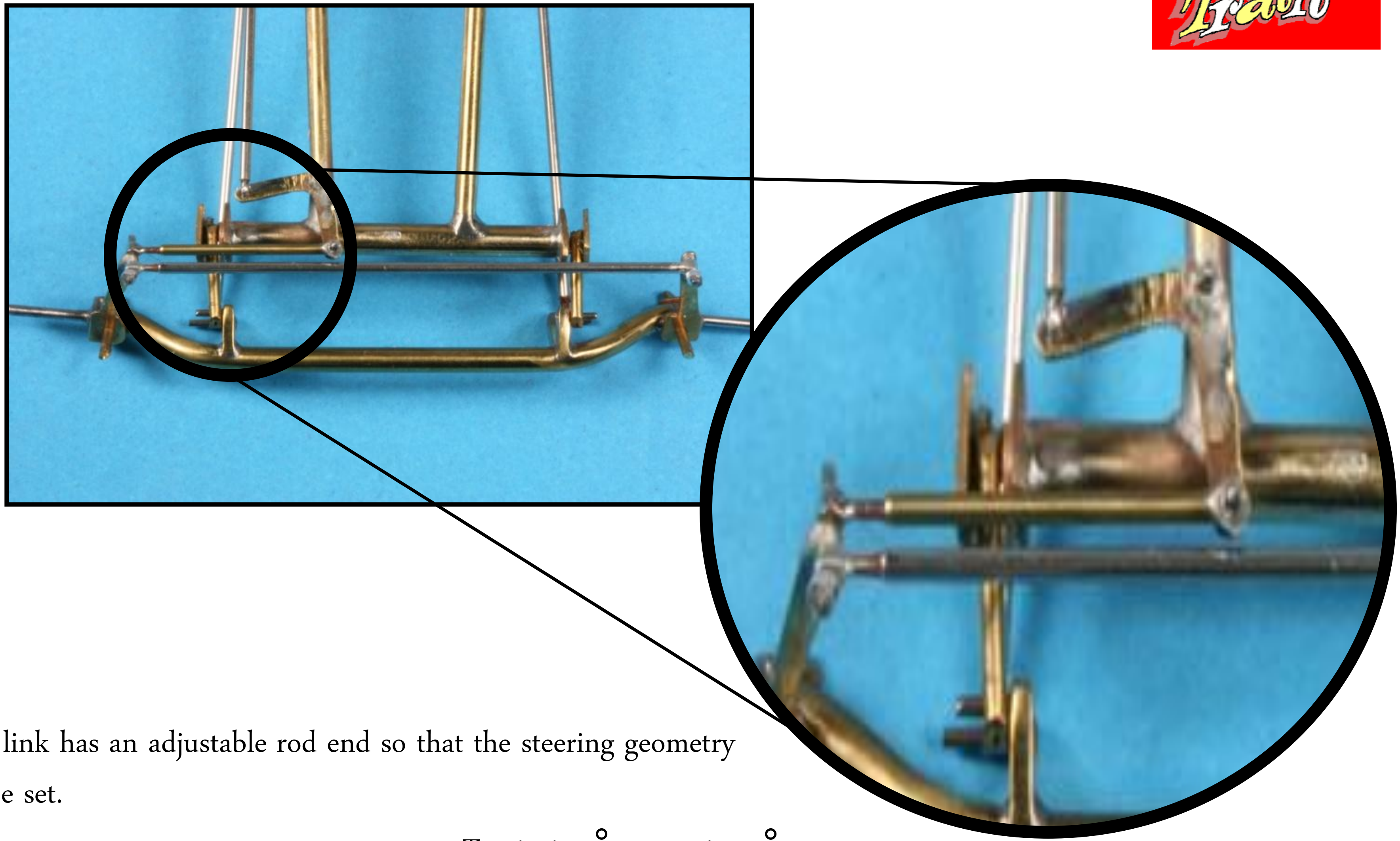
Stainless steel was selected for the links due to realistic appearance and durable finish. Chrome plated brass is a viable alternative but expensive. Alclad II finish is feasible, but not durable.

Axle Construction Method



1. Drill hole pattern
2. Rough cut out
3. Solder to axle
4. Final shaping

Adjustable Steering links

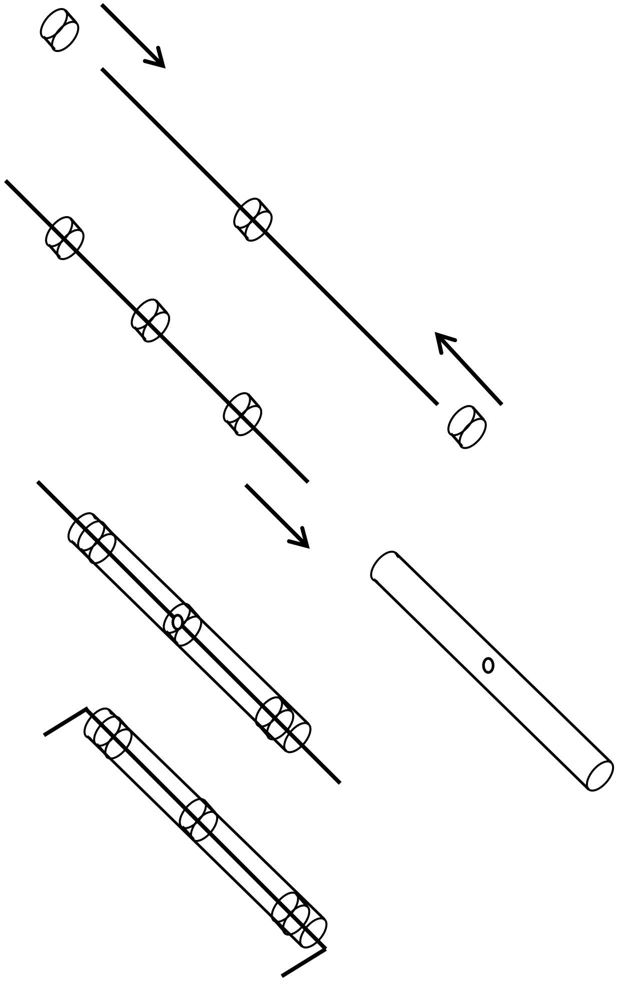


Each link has an adjustable rod end so that the steering geometry can be set.

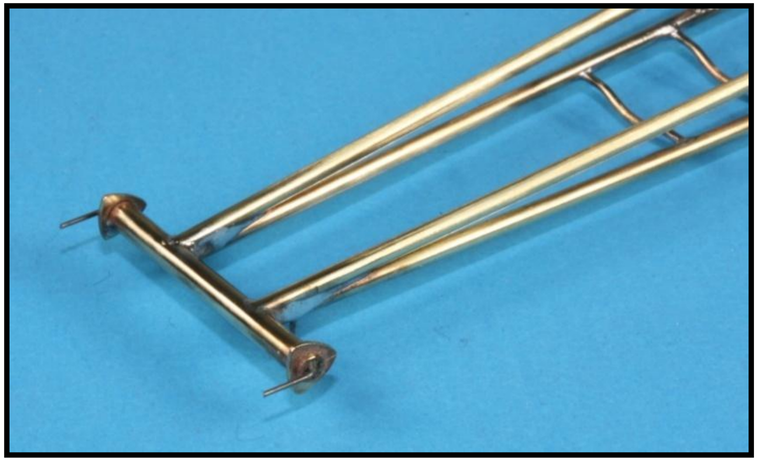
Toe-in is 0°, caster is 45°

Working Torsion Bar Front Suspension

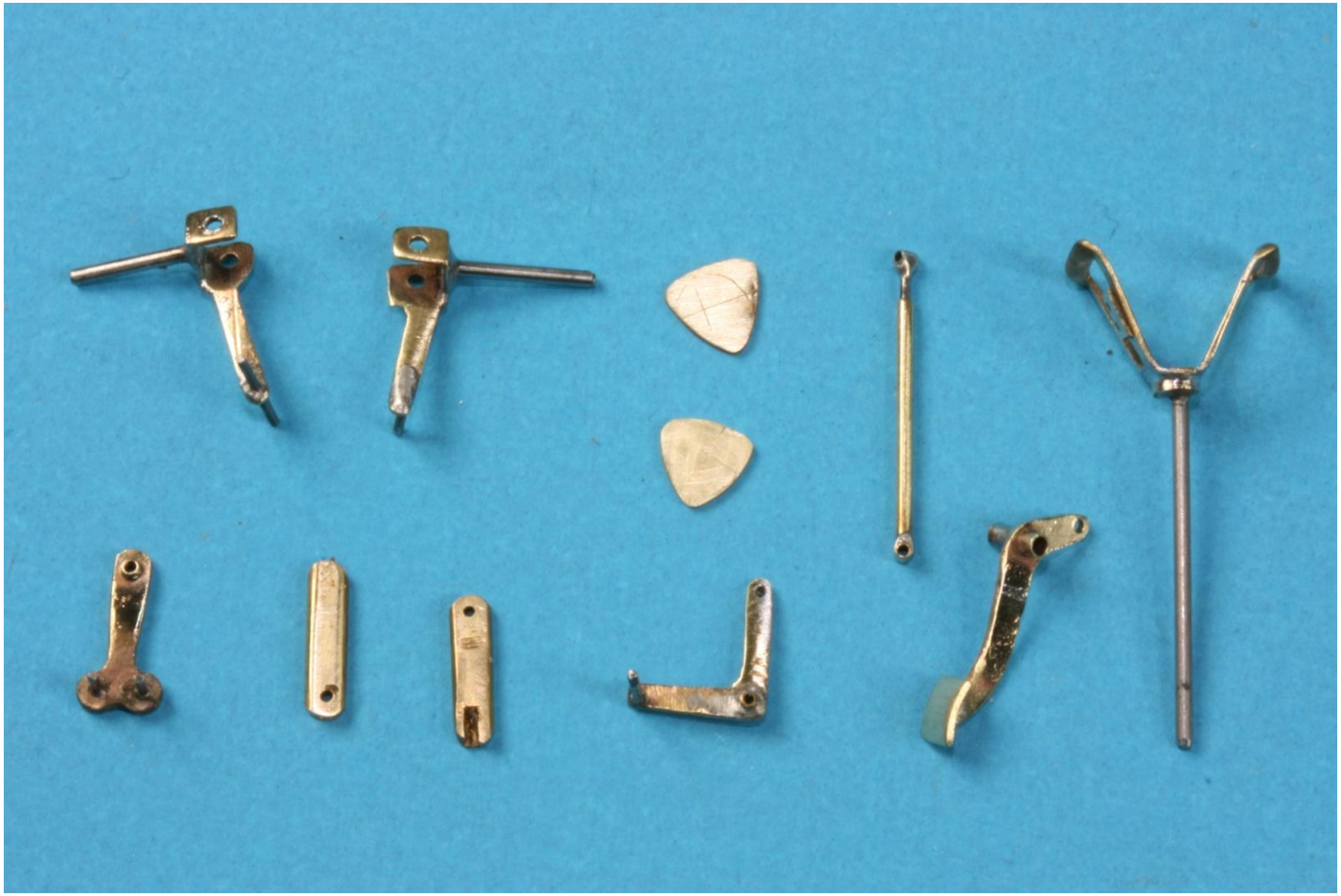
- Torsion rod is held at the center with a soldered sleeve.
- The ends of the rod pivot on brass bearings



1. Install 3 sleeves on torsion rod
2. Solder three sleeves to rod
3. Install rod/sleeve assy in tube
4. Solder center sleeve to tube
5. Bend ends of torsion rod

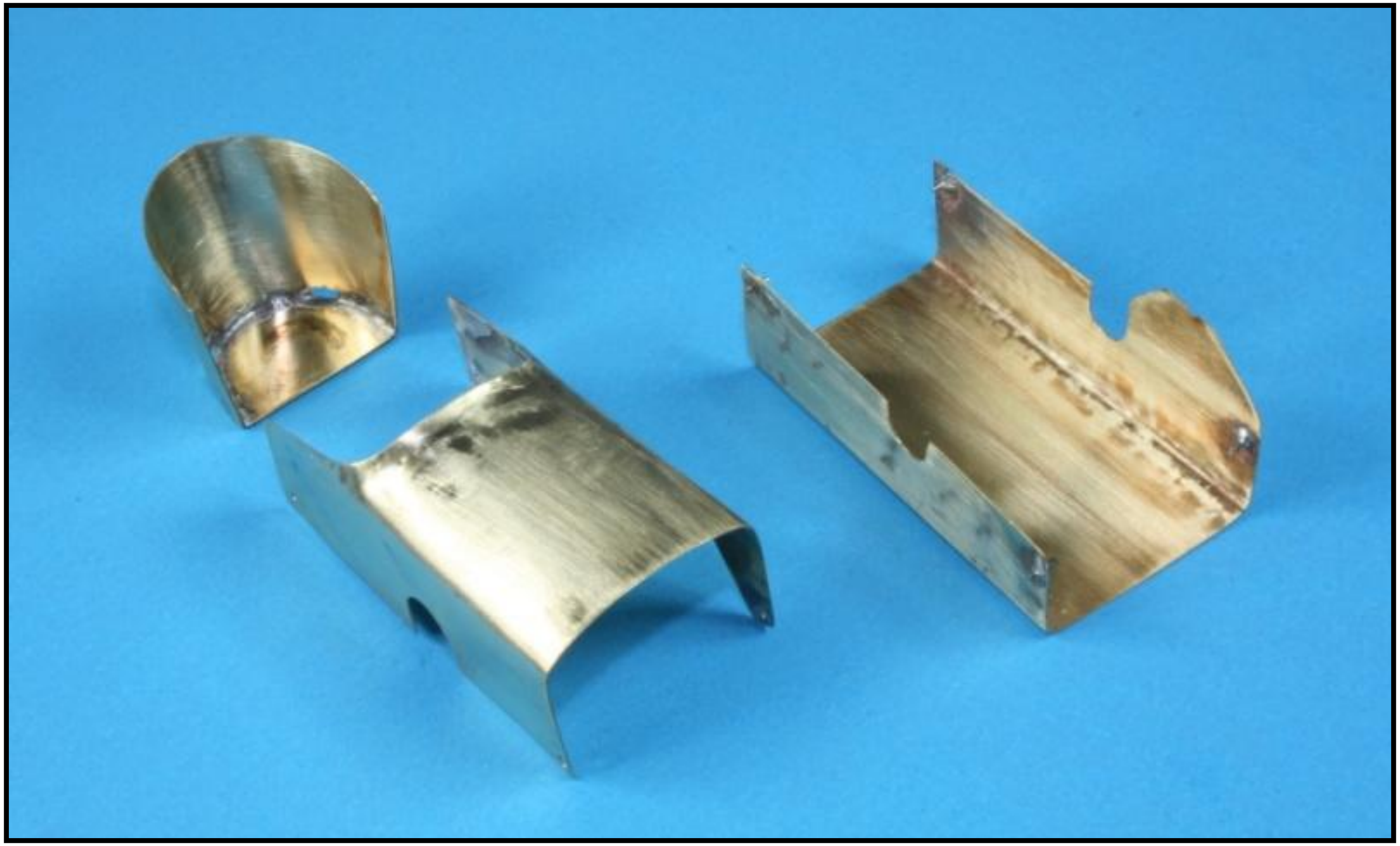


Brass Details-Steering Parts



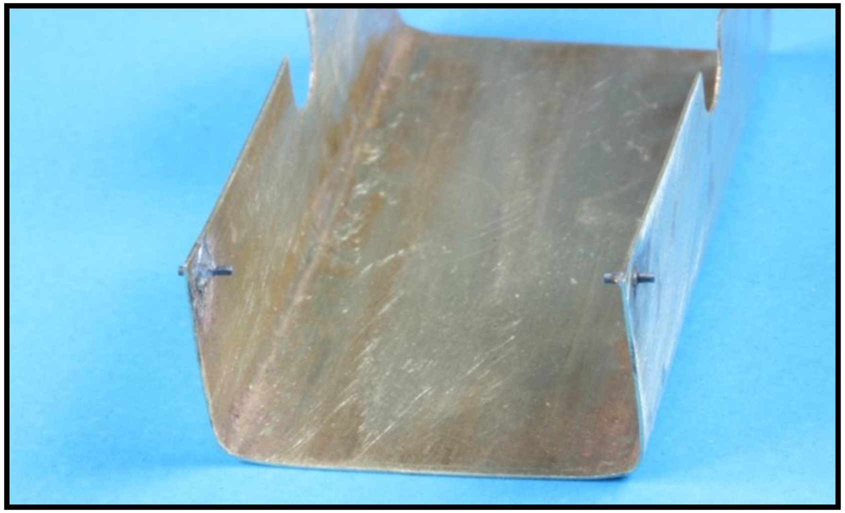
Body Construction

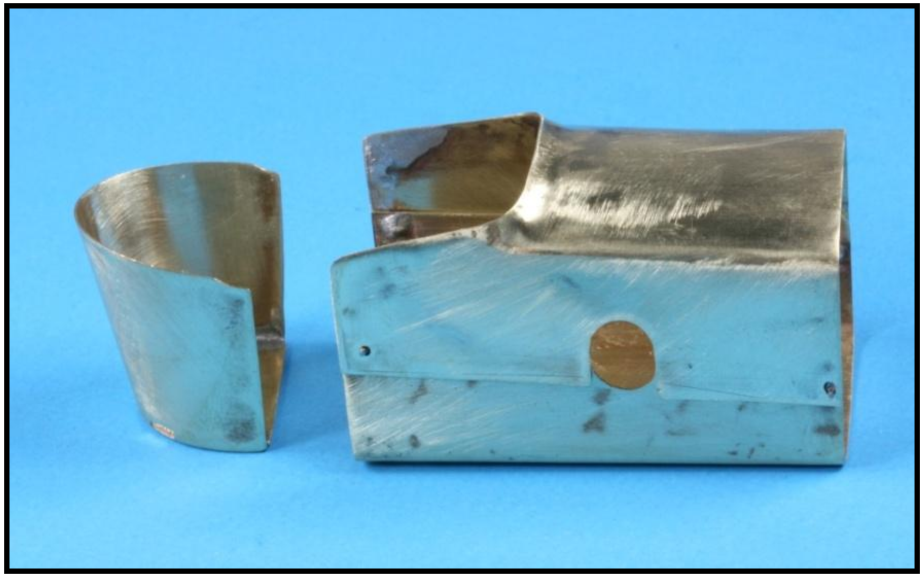
The body is formed from 0.010" brass sheet on a wood buck.
The seat base is 0.026 for rigidity and to allow shaping a radius on the outside lower edge.



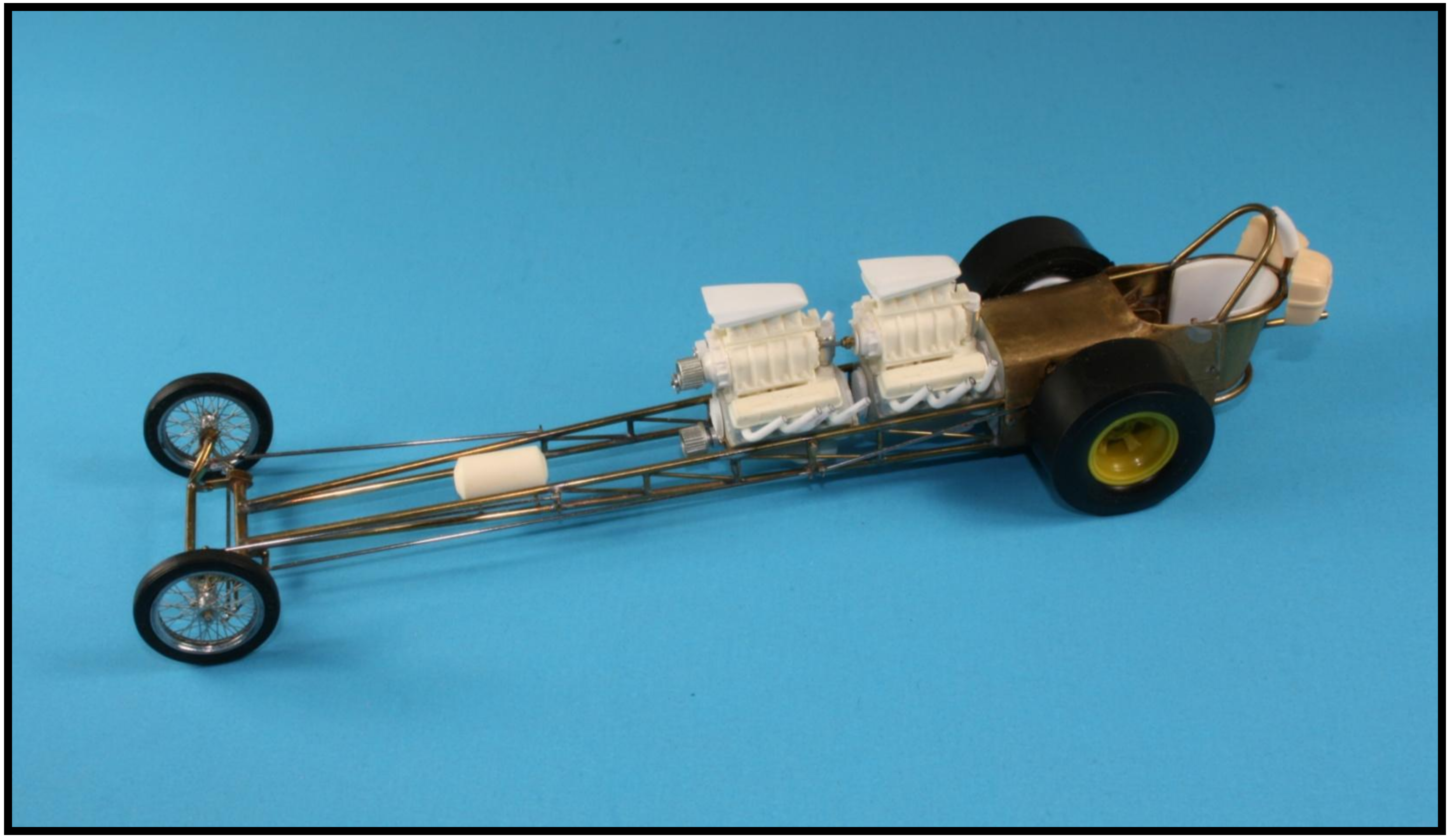
Body Construction

The upper body snaps onto pins soldered in the lower body. The same pins snap into mounts on the frame.





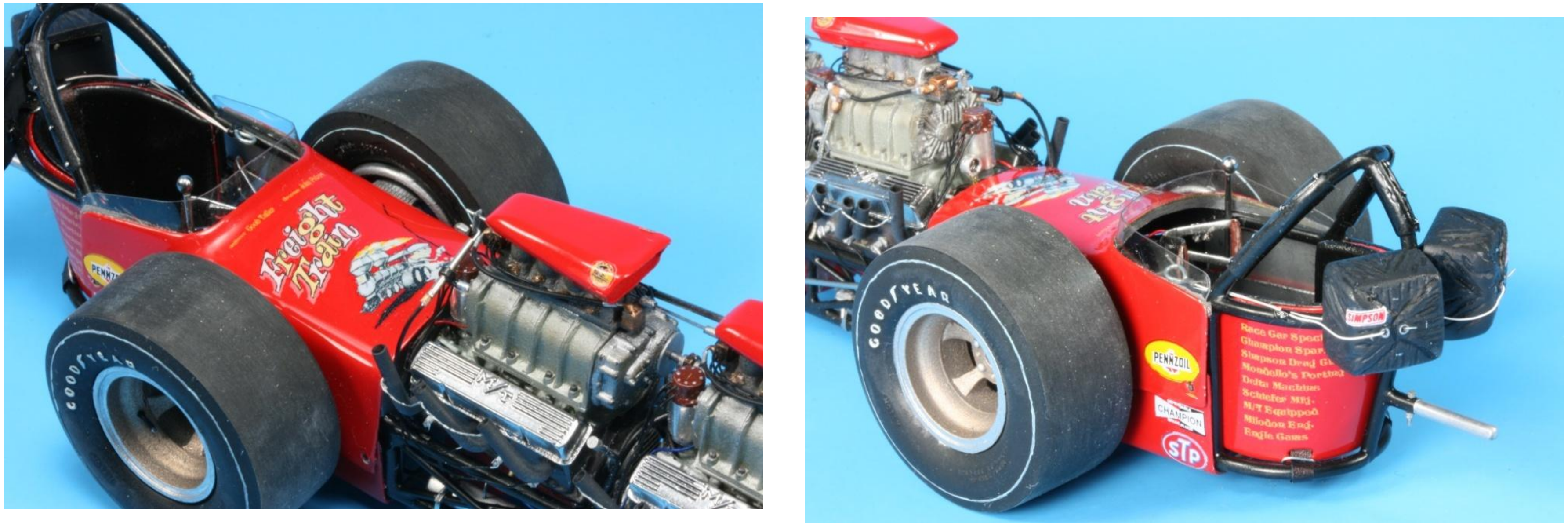
Full Mockup



The full mockup was done at the 240 hour mark, about halfway through.

Body Paint

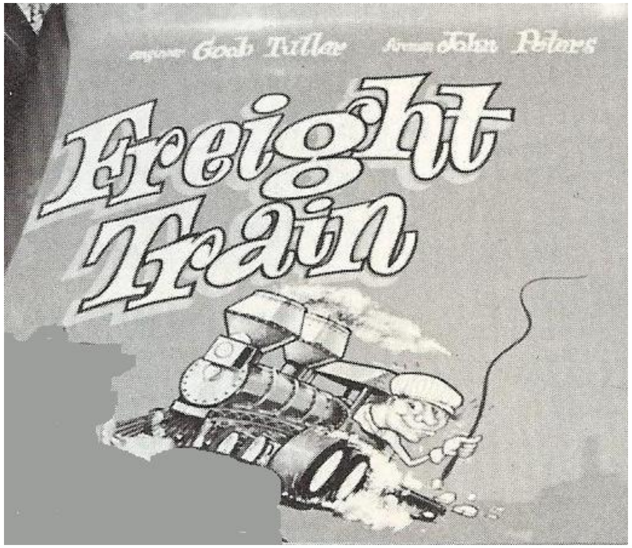
☐ Tamiya Metal Primer
☐ Duplicolor Filler-Primer
☐ Testors Model Master **Ford Engine Red** (go figure!)
☐ Two-part urethane clear coat (Transtar brand)



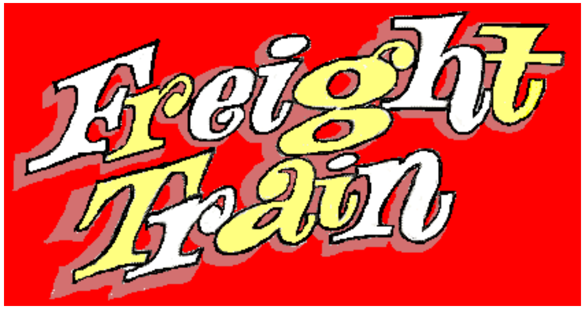
The finish is unrealistically glossy, but a necessity for a contest model.

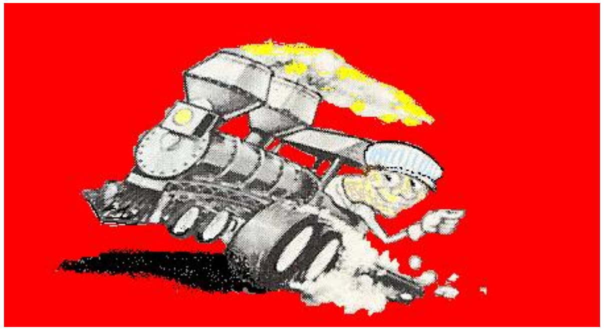
Body Graphics-Cowl Art

1. Scanned from black and white photo
2. Open file with MS Paint, clean up and color, save as bitmap file.
3. Create matching red background in MS Powerpoint
4. Import cowl art .bmp file to Powerpoint
5. Save as picture on red background
6. Import picture to Powerpoint, stretch and size.
7. Print on Testors decal paper, white.
8. Apply decal to painted body
9. Bury in clear coat to hide decal edges



Magazine reference photos

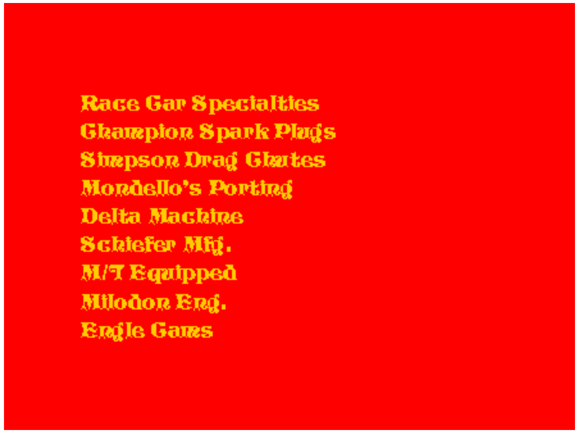




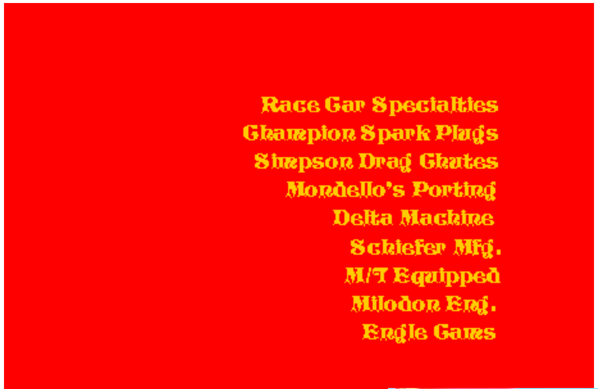
Powerpoint graphics

Body Graphics-Lettering

- Create field of matching red background
- Use text box or Word Art to create lettering in needed font and color
- Save as picture
- Import back to Powerpoint and size as needed

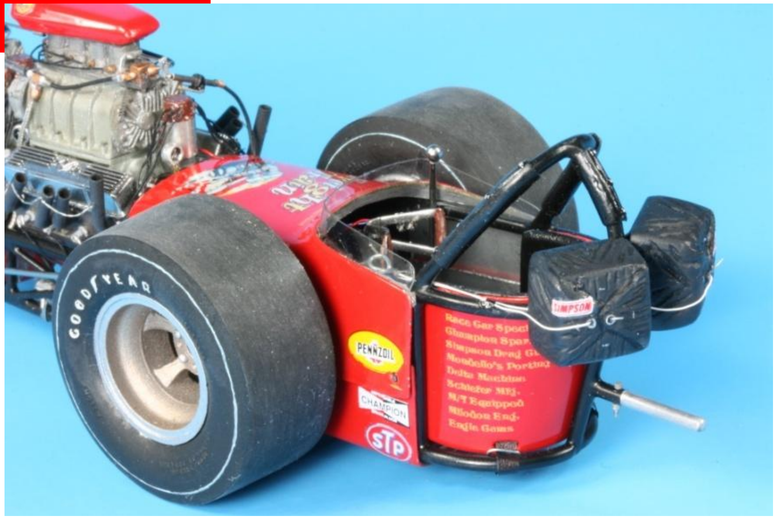


Race Car Specialties
Champion Spark Plugs
Simpson Drag Chutes
Mondello's Porting
Delta Machine
Schiefer Mfg.
M/T Equipped
Milodon Eng.
Engle Cams



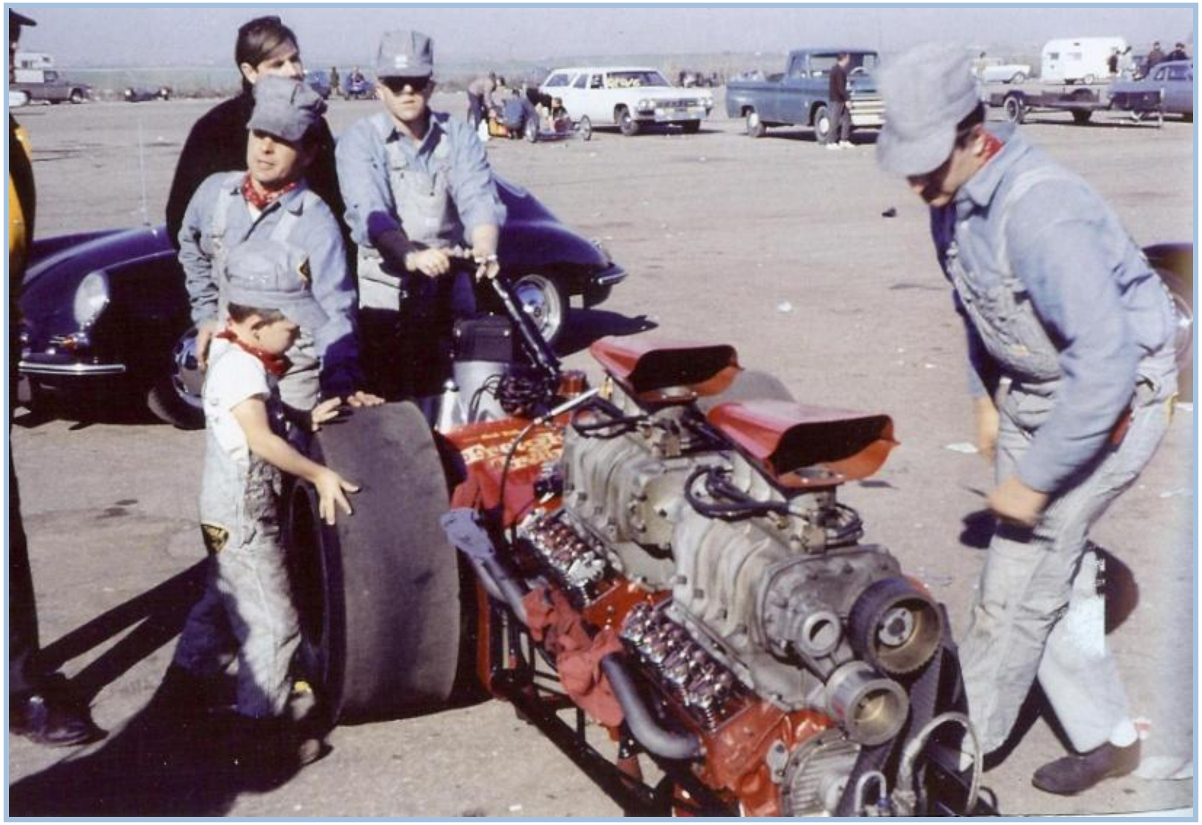
Race Car Specialties
Champion Spark Plugs
Simpson Drag Chutes
Mondello's Porting
Delta Machine
Schiefer Mfg.
M/T Equipped
Milodon Eng.
Engle Cams

Sponsor name lettering seen on rear of car



Paint-The “as raced” look

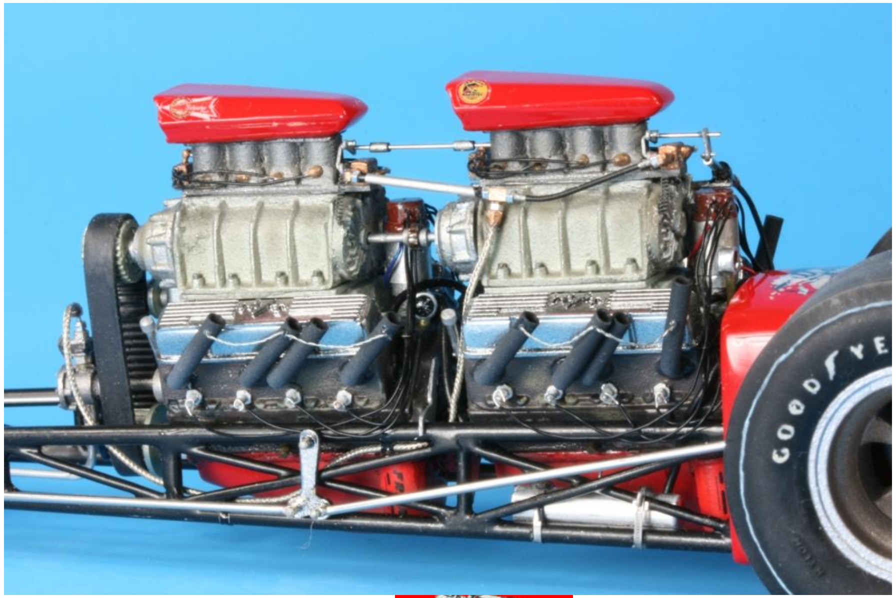
- Many drag race pit areas weren’t paved.
- The Freight Train was transported on an open trailer
- Mild grime and dirt seemed fitting for the Freight Train theme



Between rounds action at the Bakersfield Fuel and Gas Championships

Engine Finishes

- Superchargers, manifolds, injectors
  - Testors Metalizers-Aluminum, Steel, Titanium
  - Green and Yellow lacquer tint mixed in
- Engine Blocks-simulated “hot-tanked” bare cast iron
  - Model Master Chocoladen Brown ‘43 mixed with Testors flat black and steel
- Dirt, grime, and oxidation are Tamiya weathering pastels and The Detailer wash



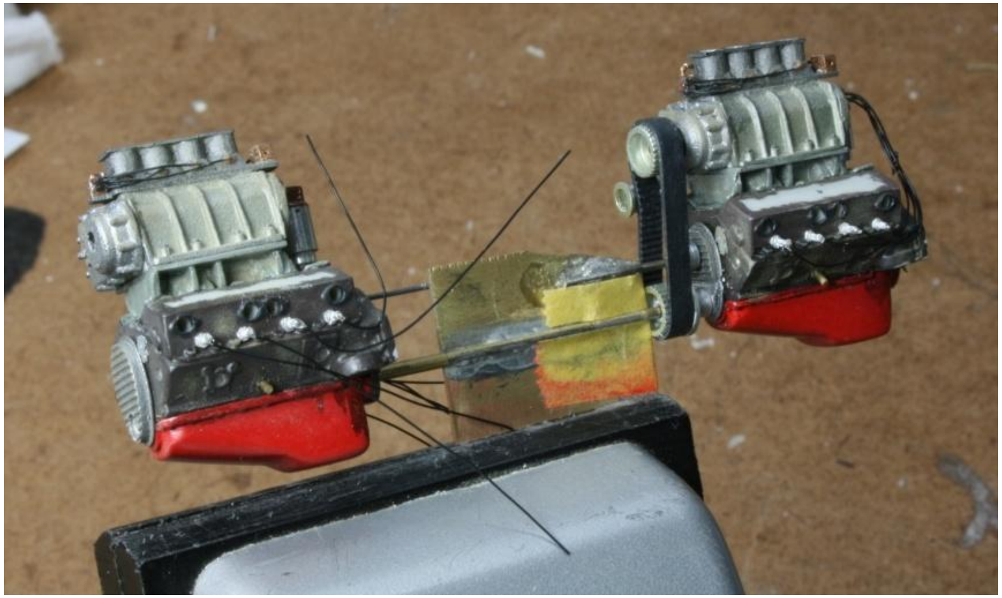
Engine Detail-Aftermarket Sources

Spark plugs- **R&D Unique**

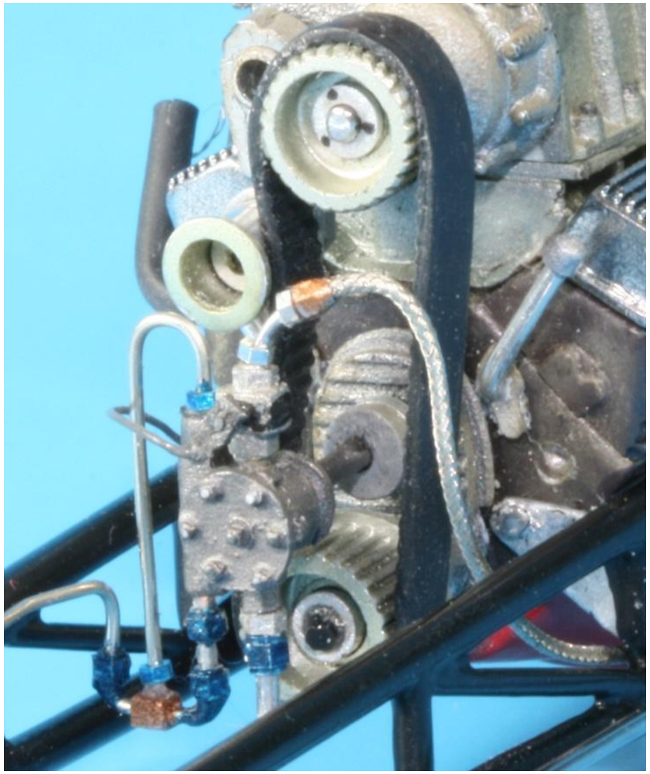
Wiring and plumbing- **Detail Master** and **Pro-Tech**

Fuel pump- **Competition Resins** (modified)

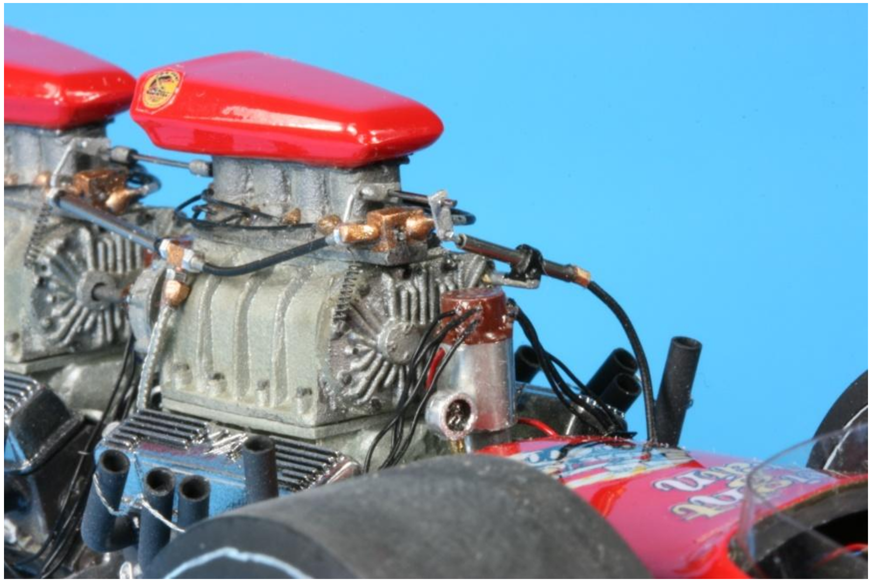
Injectors, superchargers, intake manifolds, valve covers, front covers**- Calnaga Castings**



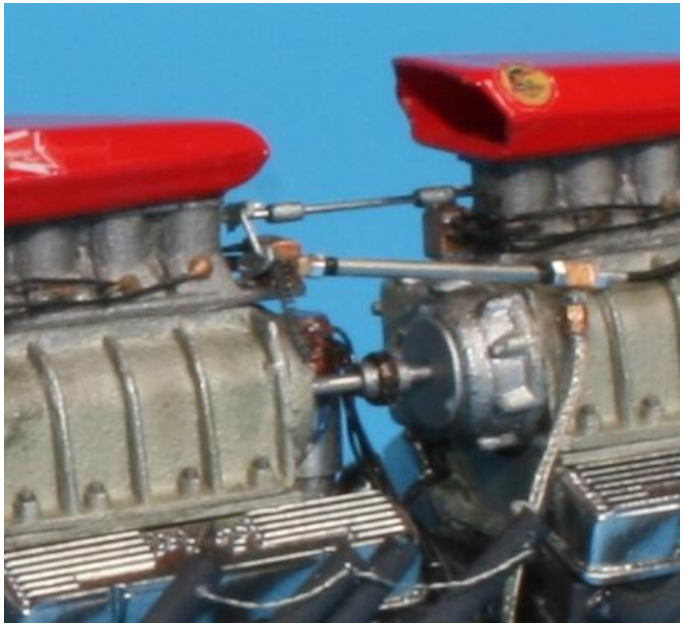
Detailing fixture



Engine Detail



Rear view shows fuel block, hydraulic throttle, magneto, oil pressure gage

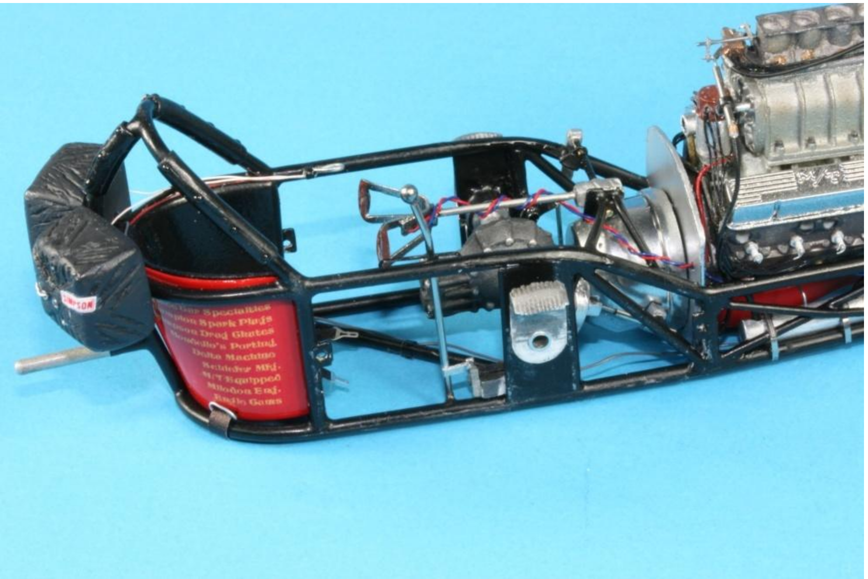


Engines are coupled at:

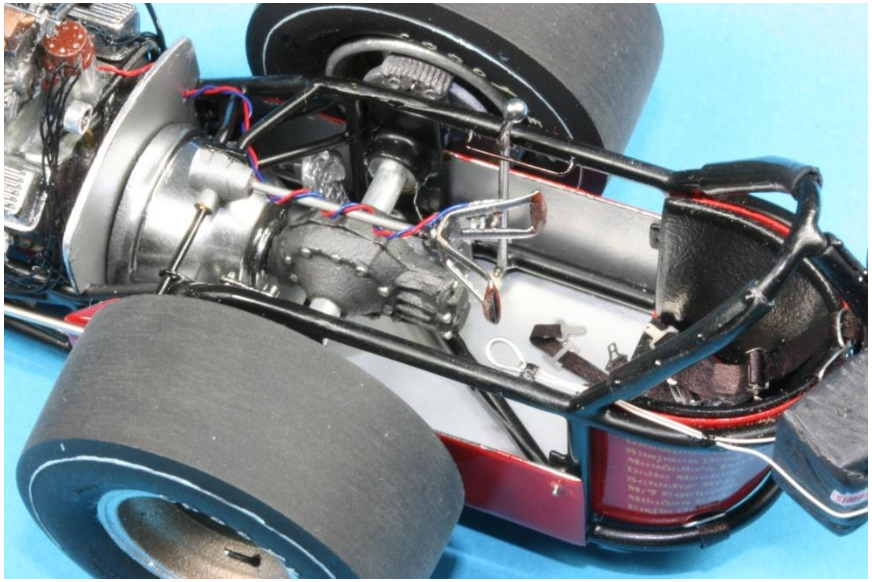
Butterfly shaft, Supercharger drive, and Crankshaft

Interior Detail

- Cowl was designed to be removeable, but it’s risky
- Judges don’t get to see this except in pictures.



RMCoM calipers, stainless brake handle

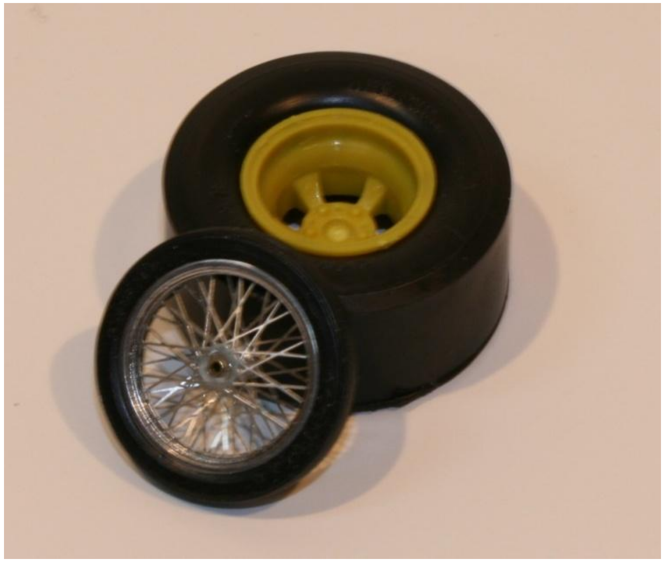


Brass butterfly steering wheel, Detail Master harness

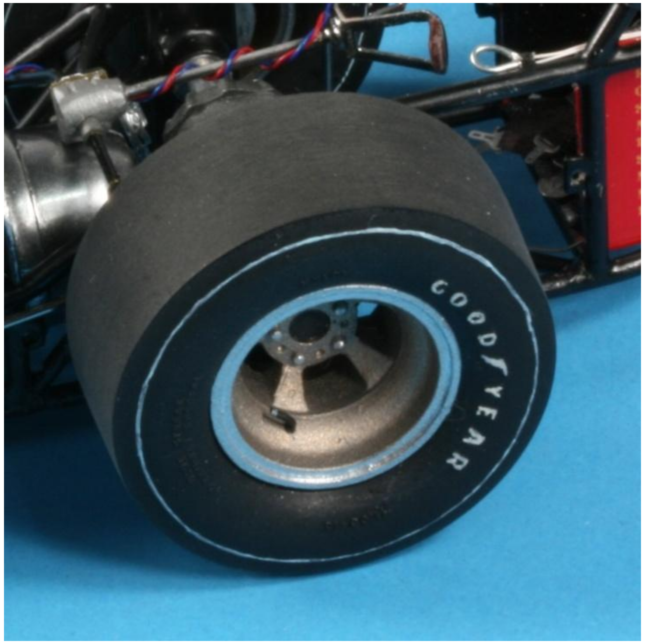
Finishes: Alclad II Plate Aluminum and Polished Aluminum

Wheels and Tires

- Front: Replicas and Miniatures Co of Maryland "Goodyears"=17"
- Rear: Polar Lights Mustang funny car wheels with Monogram Beer Wagon slicks



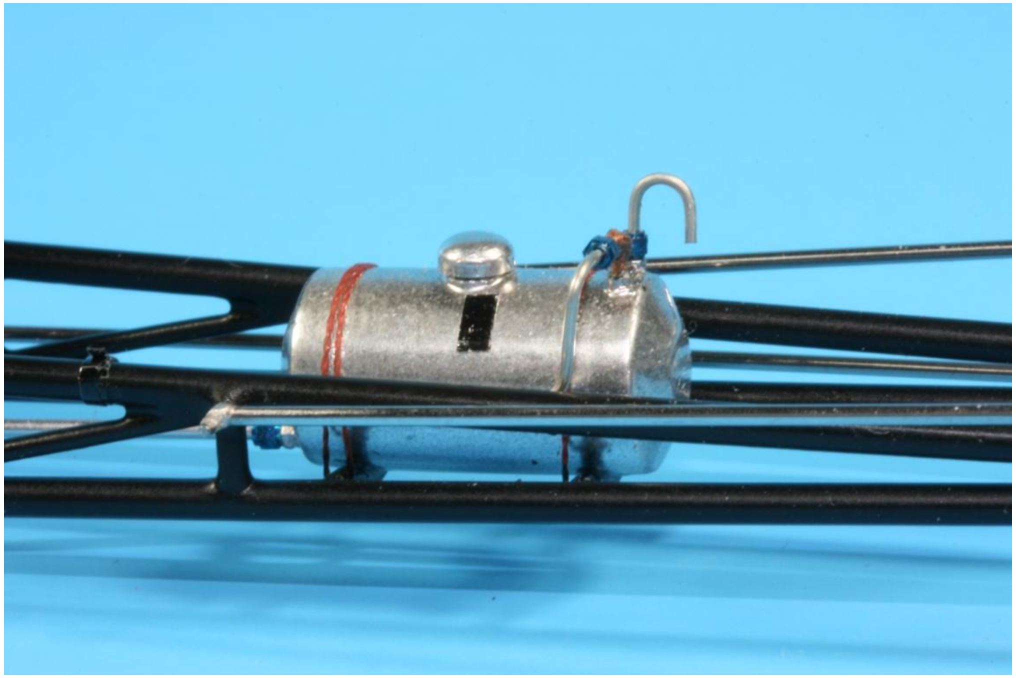
The RMCoM wheels were shot with Alclad II Chrome to cover a greenish tint on the photo-etch spokes.



Monogram show rod slicks scale out perfectly for the 11.5" Goodyear Blue Streak Dragway Specials. They have the correct lettering and sidewall stripe. Wheel finish is Model Master Titanium metalizer with a dusting of gold.

Fuel Tank

- Resin cast tank with finish of Alclad II Polished Aluminum looks more like aluminum than real aluminum! (?)



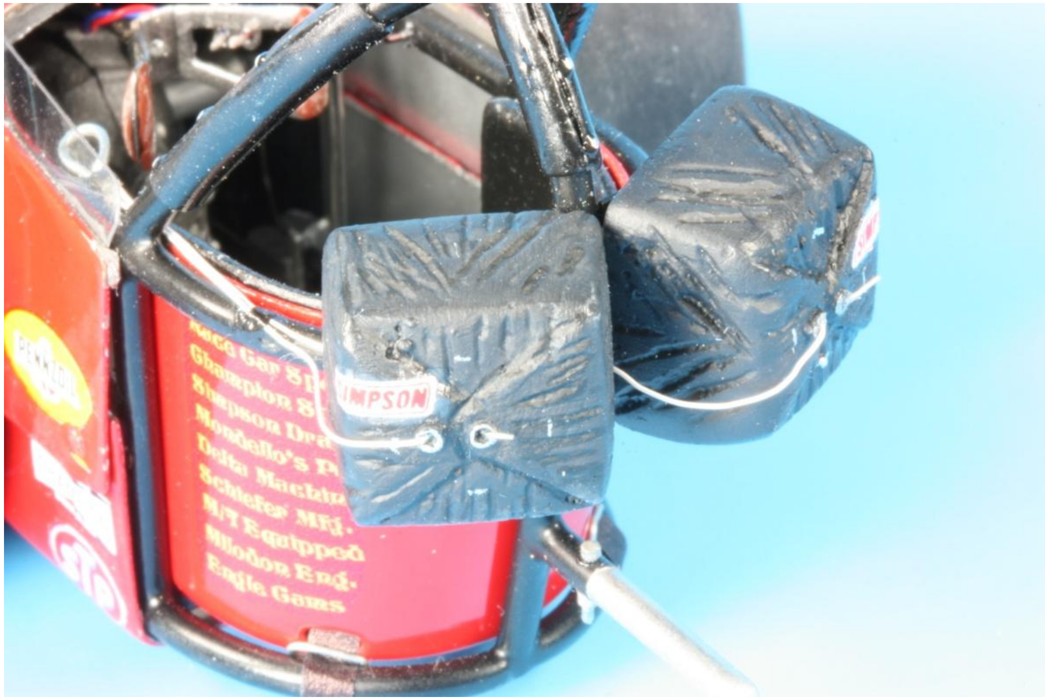
The Freight Train’s tank was held down with three bungee cords, one in the front and two in the back, duplicated here with polyester embroidery thread.

Rear Chassis Details

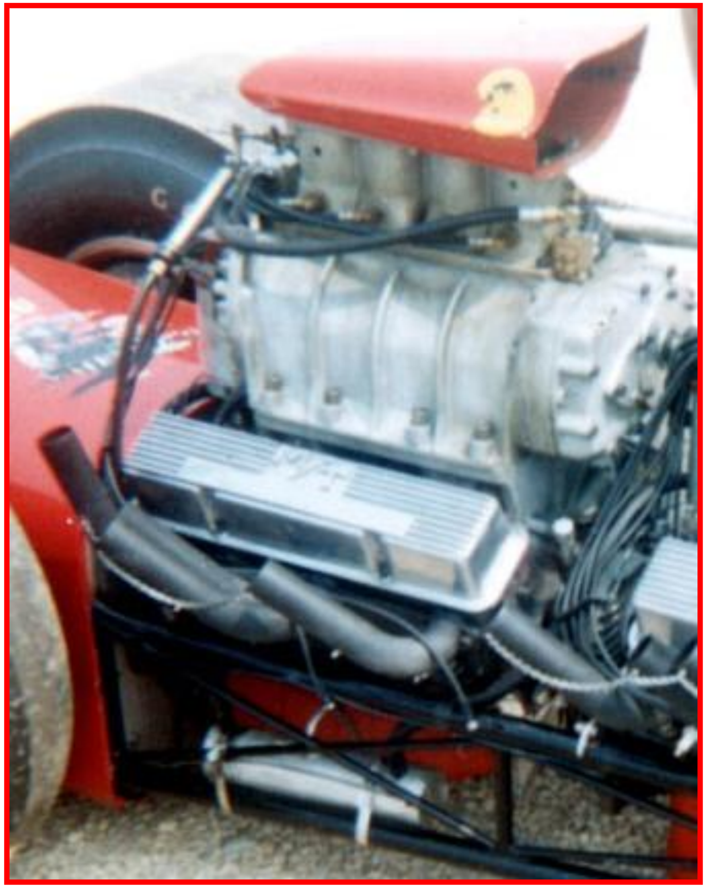
Aftermarket ‘chutes did not have the correct size or shape

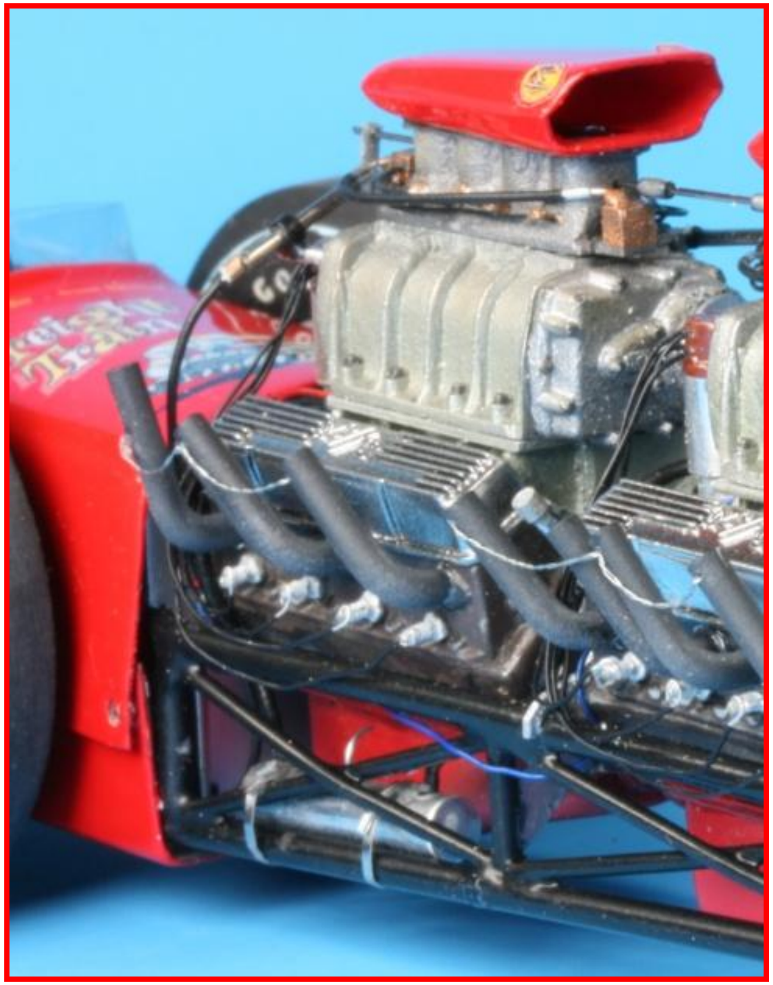
Dual 8’ Simpson ‘chutes were mastered in mahogany hardwood and cast in resin, now available from **Calnaga Castings**

Roll bar padding is actually electrical shrink tubing, available from **Comp Resins**

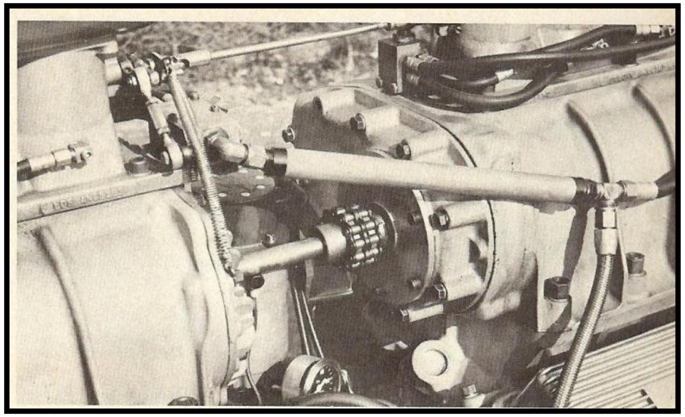


Freight Train Model as a Replica

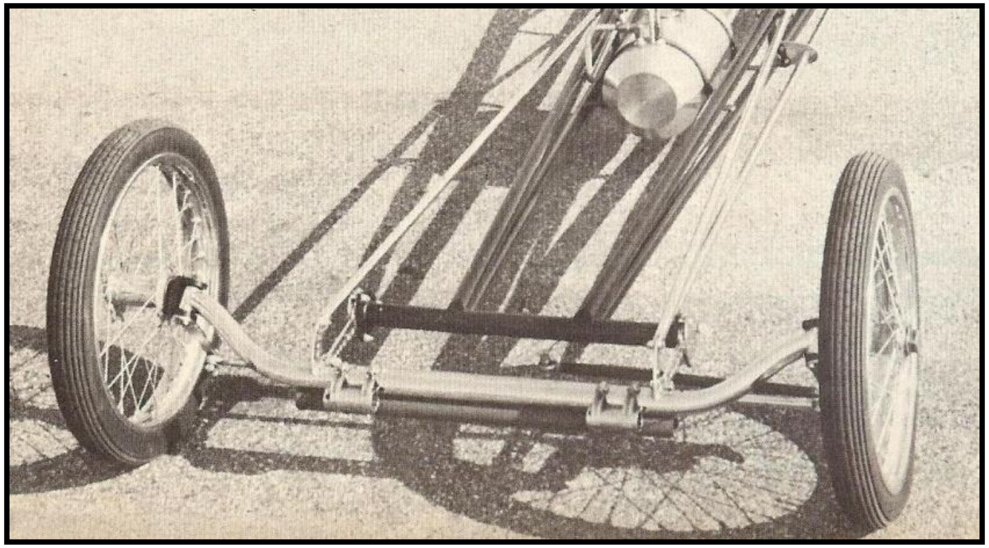




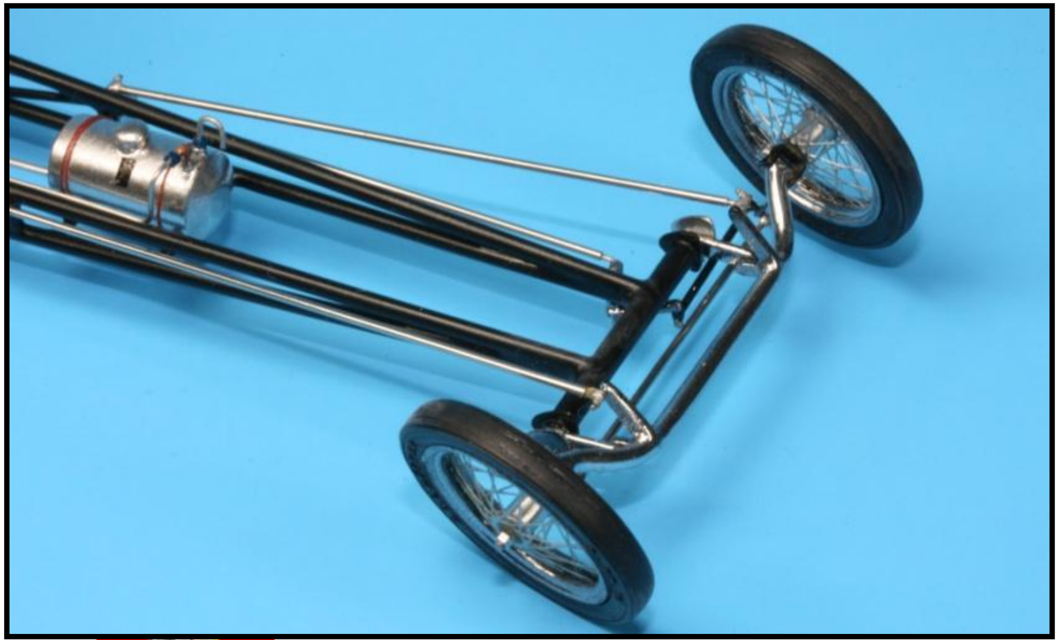
Freight Train Model as a Replica



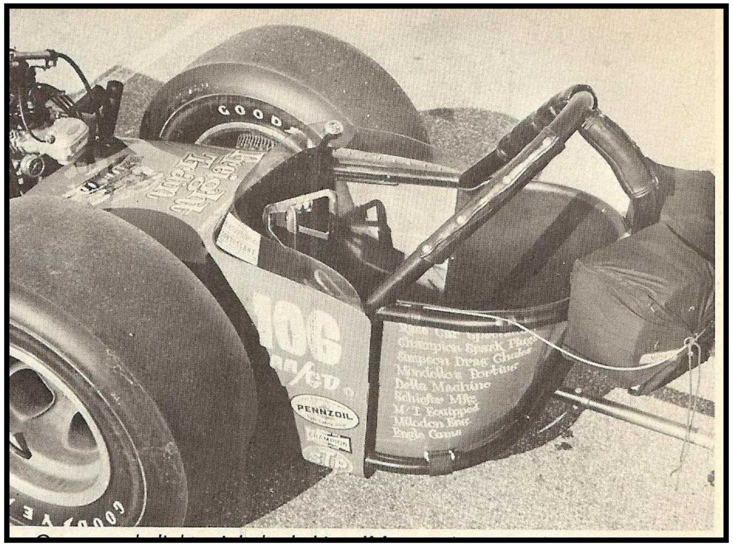
Freight Train Model as a Replica

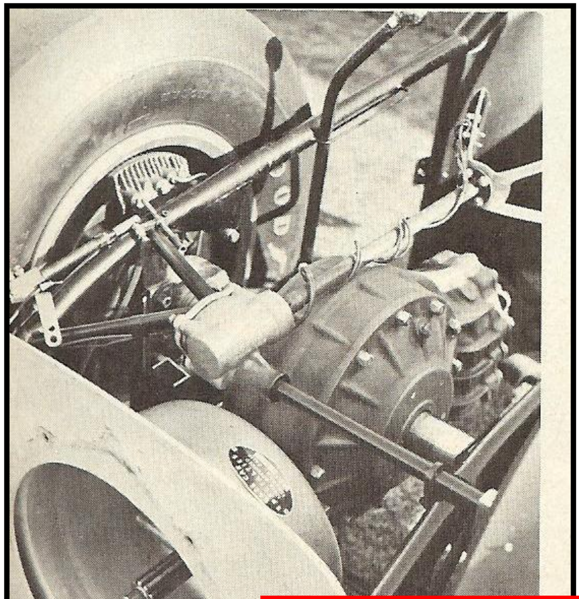


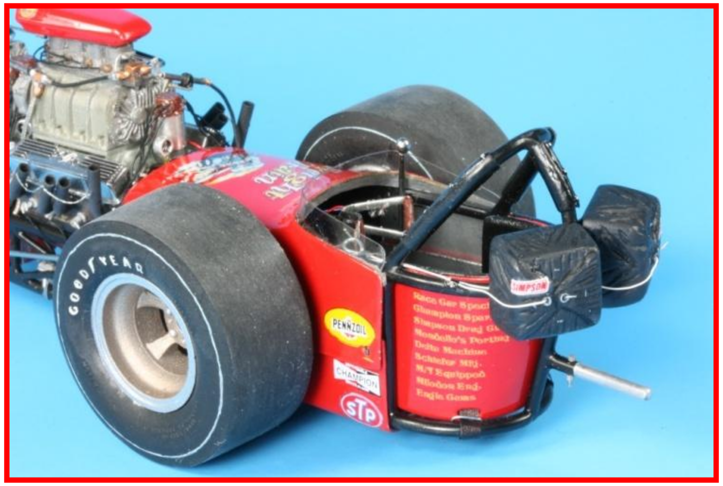
Front axle details change from race to race: Ballast is only used at tracks with high traction.

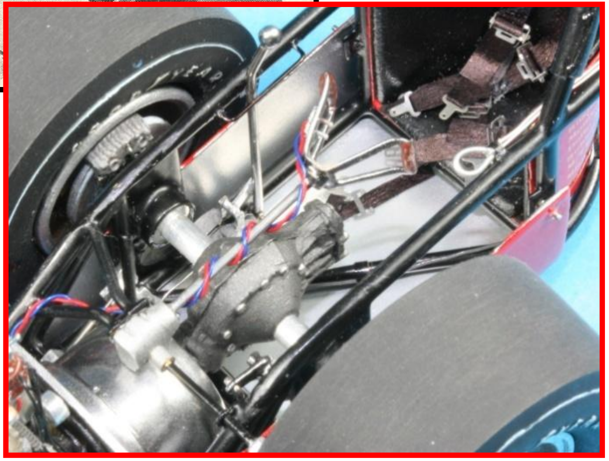


Freight Train Model as a Replica

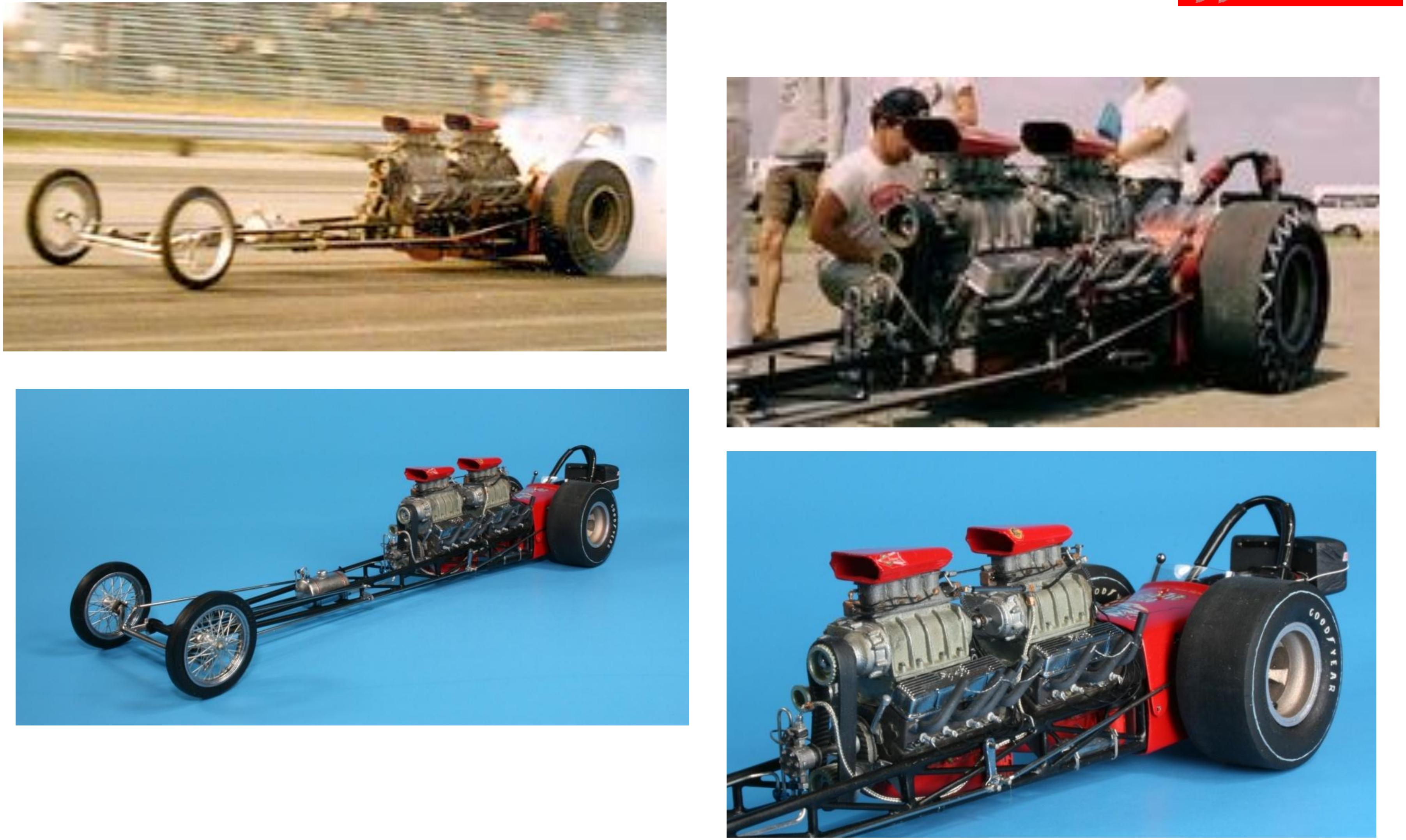








Freight Train Model as a Replica



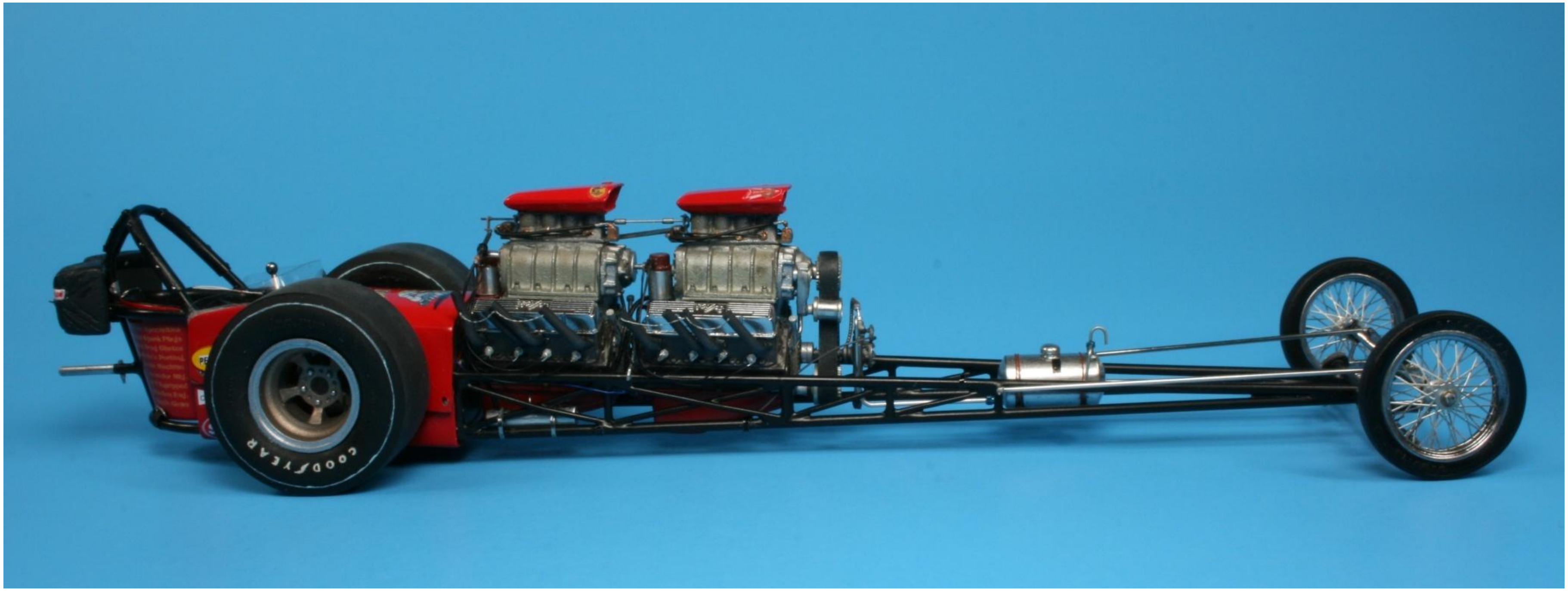
Measures of Success

Referring back to the original intended outcomes for the project:

☐ Was it fun? Yes! But it required more perseverance than expected,

- Started August 23, 2007. Finished March 30, 2009, 442 hours.

☐ Was a unique, accurate replica built? Yes!



Does it look like a model or a little Freight Train dragster?

Measures of Success (cont.)

- Contest Success?
  - GSL XXII Competition, Drag: Best in Class, The Augie Award
  - Toledo NNL, 2009: no result
  - Motor City NNL 2009 Best of Show, Bud Anderson Memorial, and Poor Boys Pick
  - DAAM Motor City Madness 2010: 1st Place, Competition In-Line, Best of Show
  - 2010 Detroit Autorama Best Drag, Best Detail, Best Engine, Best of Show

2010 Autorama awards

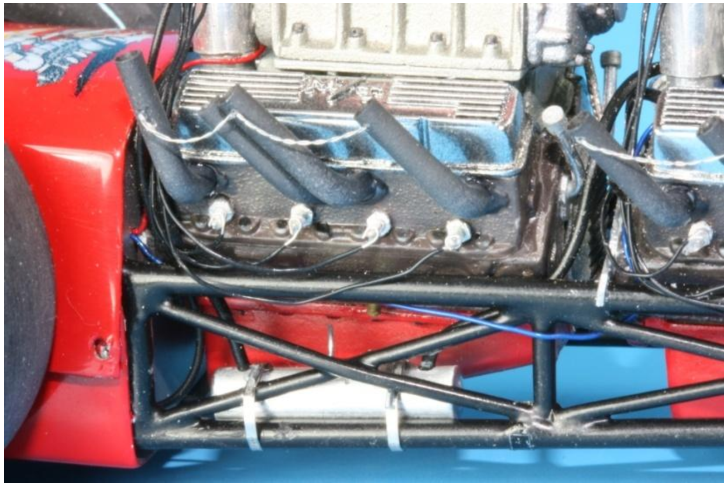
Freight Train model weighs 3.5 Oz, Poor Boys trophy weighs 16.5 lb!

Measures of Success (cont.)

- ☐ Publications?
  - ➢ Model Cars magazine Issue 143 GSL XXII show coverage.
  - ➢ Scale Auto Contest Cars 2009 GSL XXII show coverage
  - ➢ Feature article Model Cars magazine, issue 165, January 2012.

Reality Check: Did all go according to plan?

- Rear ride height needed to be adjusted after trial mockup
- Engines sit a little high in the frame
- Air scoops are a little too short
- The upper body is too tight after chassis was painted. Too difficult to remove cowl without damaging other parts.
- Chassis links "rusted" to adjustable rod ends
- Chassis was difficult to paint
- Decals were much more work than expected



The builder has the most in-depth knowledge of this model and is his own worst critic.

Conclusion

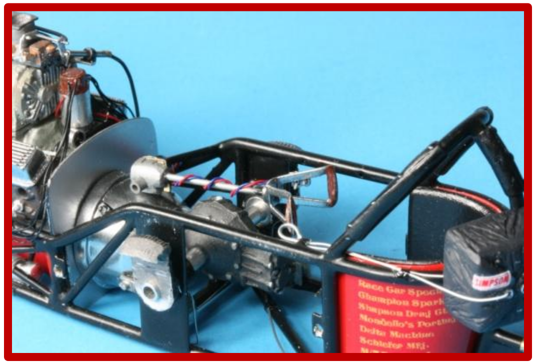
- Impact on the Hobby?
  - Time will tell..
  - Random Comments

" museum quality"

"the best builder in the club…"

"This guy needs to get a life."

Ultimately, this model did achieve what I intended, and I hope it serves as an example of what can be achieved as a scratch built replica with very simple methods.



Thanks!

Any Questions?